MARCH 1956 — TOOL SHOW NUMBER

MACHINERY

Install it... then Forget it!

The
NORMA-HOFFMANN
"Cartridge" Bearing
Needs No Attention

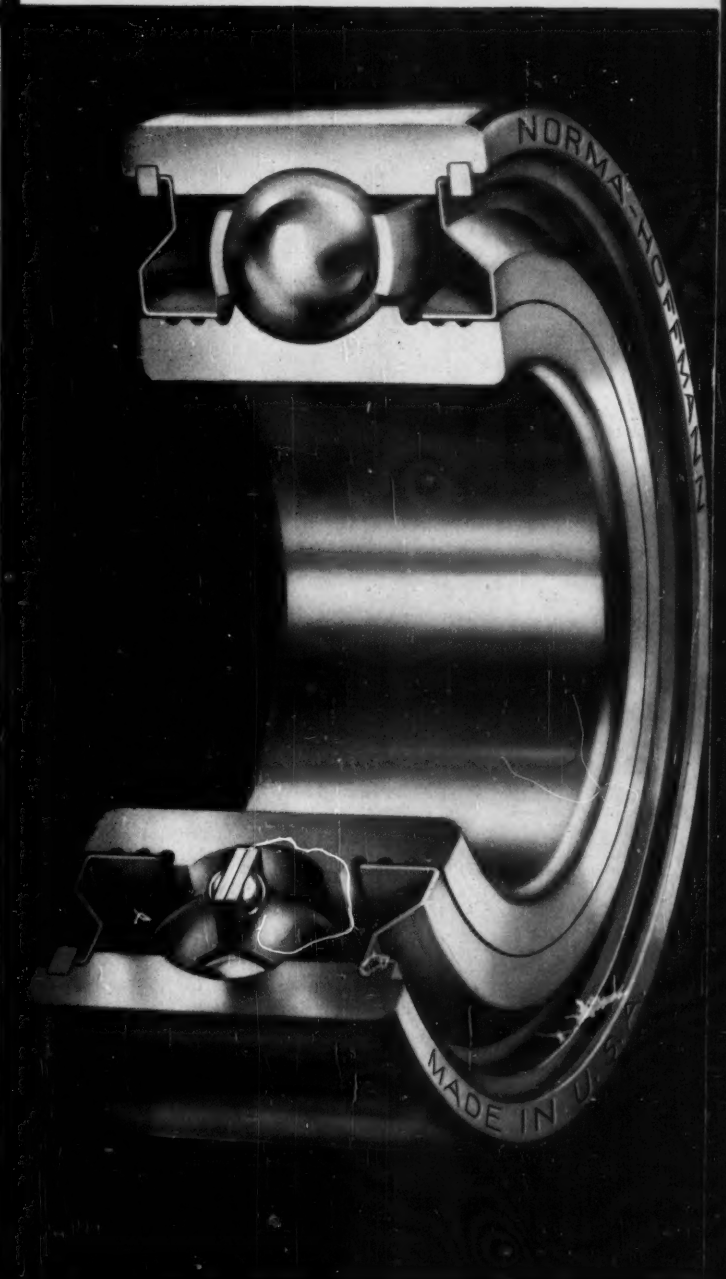
"Cartridge" ball bearings installed more than 15 years are still running without re-lubrication.

HERE'S WHY:

"Cartridge" double row width bearings are complete units — ready for installation.

"Cartridge" bearings are adequately lubricated — with correct amount and the right kind of grease.

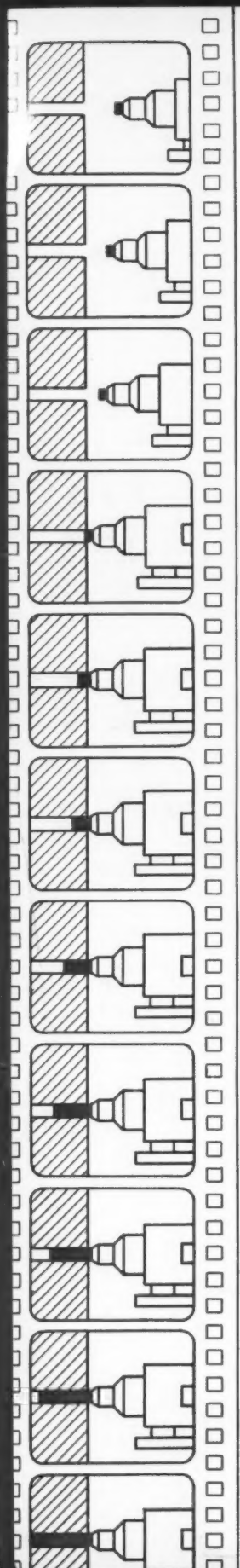
"Cartridge" bearings are fully protected — with highly efficient all-metal, non-rubbing, lifetime seals.



NORMA-HOFFMANN *Precision* **BEARINGS**
BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT
FOUNDED IN 1911

FIELD OFFICES: Atlanta, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, San Francisco, Seattle

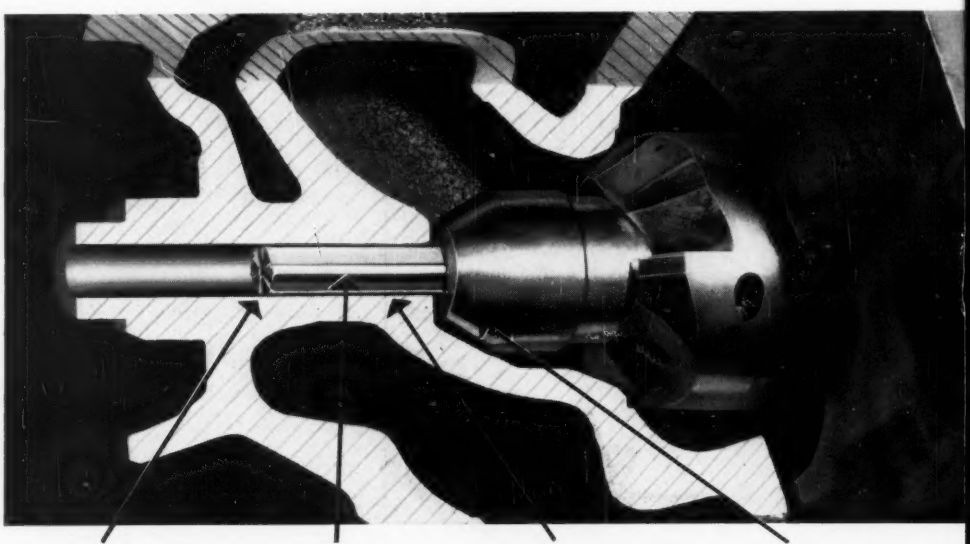


New Heald Method of

BORE REAMING

keeps small-hole finishing

on the STRAIGHT AND NARROW



CUTTING ACTION takes place here, at BORE REAMER end face.

FLUTED EDGES support BORE REAMER and provide chip clearance.

BORE REAMER, of solid tungsten carbide, feeds out into hole.

SUPPORT BUSHING rotates with the BORE REAMER.

IT'S NOT *boring*, not *reaming*—but a unique combination that gives you the desirable features of *both*. For long, small-diameter holes, BORE REAMING provides a high degree of accuracy and precision economically.

The BORE REAMING tool, or BORE REAMER, is firmly supported by a rotating bushing, immediately next to the face of the work, and is fed outward into the hole by a mechanical or hydraulic feed-out mechanism. Cutting action takes place only at the outer end edge of the BORE REAMER *face*. It penetrates as straight and true as a single-point boring tool, without a conventional reamer's tendency to follow irregularities in the drilled hole. Since the support bushing rotates with the BORE REAMER, the only wear is from the slow in-and-out movement of the tooling.

Finish size of any hole is determined solely by the BORE REAMER diameter—hence a change in hole size is simply a matter of changing the BORE REAMER, with no need for delicate tool adjustments.

If you do work that falls into the BORE REAMING class, this is something you should look into. Your Heald representative will be glad to give you the complete story. Remember, IT PAYS TO COME TO HEALD.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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BPA NBP

MACHINERY

Volume 62 MARCH, 1956 NUMBER 7

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Improving Performance of High-Speed Steel Tools *By F. J. Pohlmeyer* 152
How to Calibrate Your Gage-Blocks..*By Frederick O. Hutchinson* 160
Automated Stamping of Rear-Axle Housings..*By Charles H. Wick* 168
Rotary Cutters Used in Proto-Turning 180
Producing Accurate Holes ..... *By Carl J. Oxford, Jr.* 186
Precision to a Fraction of a Light Wave ..... *By M. S. Hoskins* 190
Preview of Equipment to be Seen at the Show 194

MACHINE AND TOOL DESIGN

Designing Progressive Dies ..... *By H. C. Tsien* 147
Tapping Titanium Demands Special Consideration..*By Earl Cook* 176
How Much Torque is Needed for Threading Bolts and Pipe *By R. J. Martin* 183
Automatic Press Line for England 227
Accurate Location of Three Holes by the Disc Method *By Jay N. Edmondson* 232
Yardsticks for Industry Shrink to a Millionth of an Inch 233
American Standard Machine Pins (Data Sheet) 267

MANAGEMENT PROBLEMS

Defense Department About-Faces in Machine Tool Procurement *By Loring F. Overman* 139
Tooling for Tomorrow—on Exhibit Today .. *By Charles O. Herb* 141
Automation Facts—Not Fancies ..... *By Dr. H. B. Osborn, Jr.* 144
Sales Control Versus Sales Leadership .....*By Bernard Lester* 231

DEPARTMENTS

Keeping Up with Washington 139
Talking with Sales Managers 231
Problem Clinic 232
The Latest in Shop Equipment 234
New Catalogues 255
Between Grinds 260
News of the Industry 264
Data Sheet 267
Coming Events 276

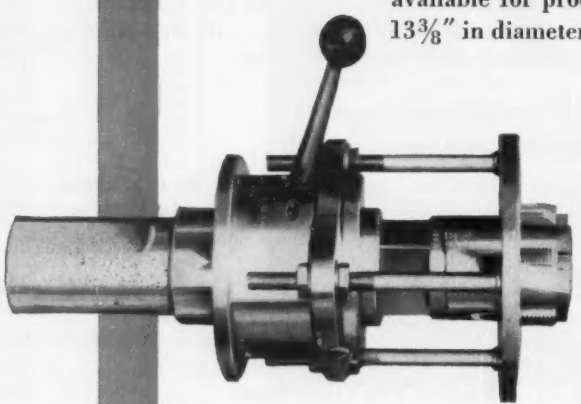
Product Directory 298

Advertisers Index 411-412

LANDIS Collapsible Taps

Sensitive Collapsing Action

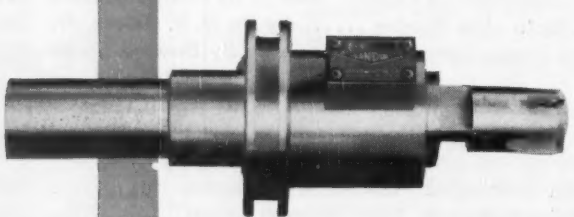
The design of LANDIS Collapsible Taps reduces tool wear, "torn" threads and tapping time by permitting direct removal from the workpiece without reversing or "backing out". The sensitivity of this "collapsing action", which automatically withdraws the chasers from the completed thread, assures uniform thread lengths and threading to a shoulder with safety. Various sizes of LANDIS Taps are available for producing straight or tapered threads from $1\frac{1}{4}$" to $13\frac{3}{8}$" in diameter.



Stationary Tap

ALT TAPS for straight threads

These taps feature a rugged construction and design simplicity which enable maximum chaser rigidity. The same tap may be used for either stationary (shown) or rotary application. Tapered threads can be tapped using chasers cutting across their entire width.



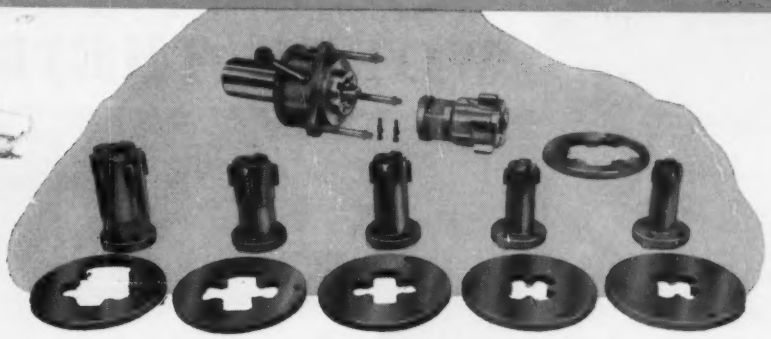
The Rotary Tap

LL TAPS for tapered threads

The thread taper is produced by mechanical receding action of the chasers during threading. This action reduces cutting strains by restricting cutting action to the chaser throat or chamfer section. As little or no "cold working" can result, LL Taps are ideally suited for tapping tapered threads in stainless steel. These taps will also produce straight threads, and are available for either stationary or rotary applications.

Sensitive Collapsing Action

Straight or Tapered Threads Rotary or Stationary Use



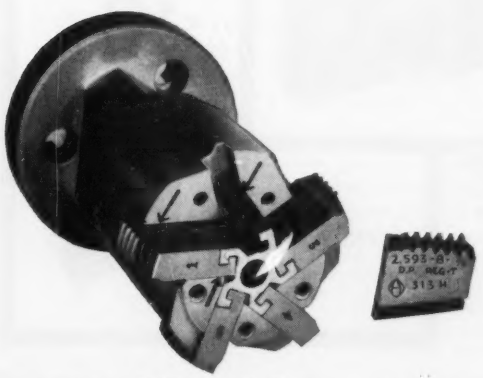
These THREADING TOOLS displayed at Booth 578 ASTE Show

Wide Range Coverage

Detachable heads are a feature of all LANDIS Collapsible taps. This design allows tapping a wide range of thread diameters with minimum tooling—for example, the 3ALT body using 6 different heads will tap all diameters from 1¼" to 3¼". Each tap head itself has a wide threading range—the 1½" head will thread from 1⅜" to 1⅝", the 2" from 1⅞" to 2-5/16", the 3" from 2¾" to 3¼".

Maximum Rigidity

The basic design of all LANDIS Tap Heads assures maximum bearing support between the chaser, plunger and tap head body. In the cross-section illustration, note the heavy metal sections which provide rigidity to the chasers and plunger, particularly at the points where cutting strains are transmitted.



Size Adjustment Ease

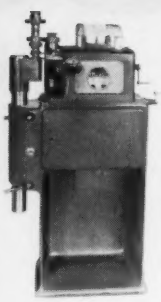
All LANDIS Taps are designed so that they may be quickly adjusted approximately 1/32" over or under the nominal chaser size. The ratchet-type size-adjusting screw is conveniently located in the front of the tap. The movement of one ratchet tooth provides a self-locking diametrical adjustment of .001".

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA • U. S. A.

430-C THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT CUTTING - TAPPING - GRINDING - ROLLING

Straight or Tapered Threads Rotary or Stationary Use

WORTH THEIR



Fellows
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Instruments

SEE FELLOWS
AT THE ASTE SHOW
—BOOTH 544
International Amphitheatre
CHICAGO
MARCH 19th - 23rd

THE
PRECISION
LINE

WEIGHT IN PROFITS

Fellows Gear Inspection Instruments with Chart Recorded Proof of Gear Accuracy

Deviations of the "red line" on a chart from a Fellows Gear Inspection Instrument, not only warn of costly gear errors—but indicate the nature of that error. Proper adjustments can thus be made immediately before expensive rejects accumulate in long production runs.

The use of Fellows Gear Inspection Instruments to continually "spot check" gears keeps waste of time, labor and materials to a minimum... provides undeniable chart recorded proof of gear accuracy... guarantees superior performance for the life of your product.

- **For composite check,** FELLOWS RED LINERS record gear errors in combination on a chart as the precision master rotates in intimate contact with the gear being checked. 3 models to 18" p.d.
- **For checking lead,** FELLOWS LEAD MEASURING INSTRUMENTS check various leads—also crown and taper. No involved calculations required. Errors charted by an electronic recorder at 500 to 1 magnification. 12", 24" p.d. models.
- **For checking involute profiles,** FELLOWS INVOLUTE MEASURING INSTRUMENTS check accuracy of involute profiles—also location of involute modifications. Electronically provide charts at 500 to 1 magnification. 12", 24" p.d. models.

There's a Representative in any Fellows office who will be glad to show you how to operate Fellows Inspection Equipment...and just how, in your operation—Fellows Gear Inspection Instruments can be "worth their weight in profit".

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2
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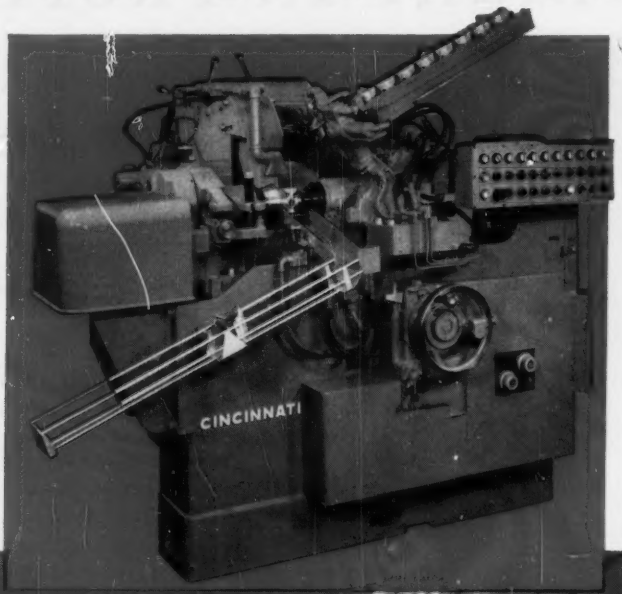
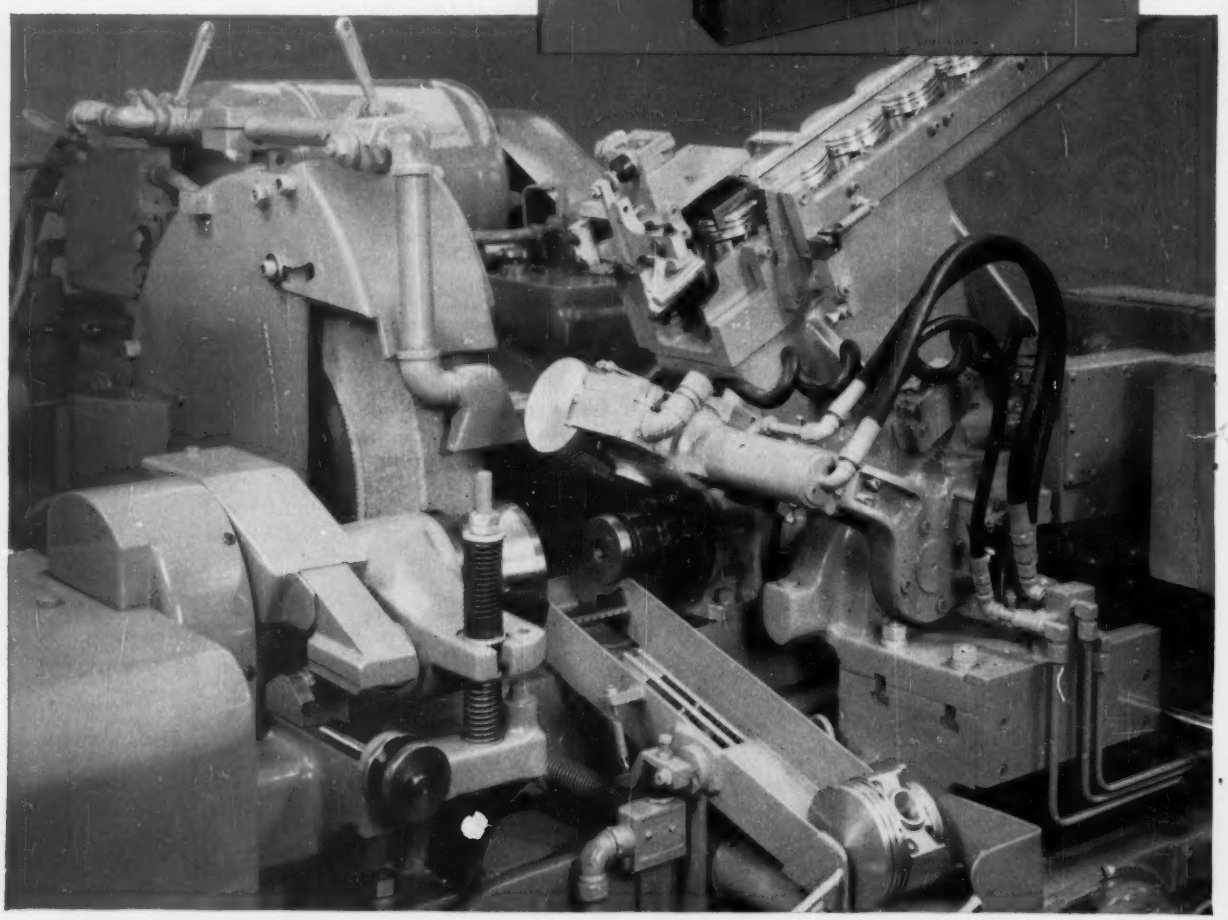
Fellows *Gear Production Equipment*

Fully Automated Cincinnati

Grinds 130 automotive

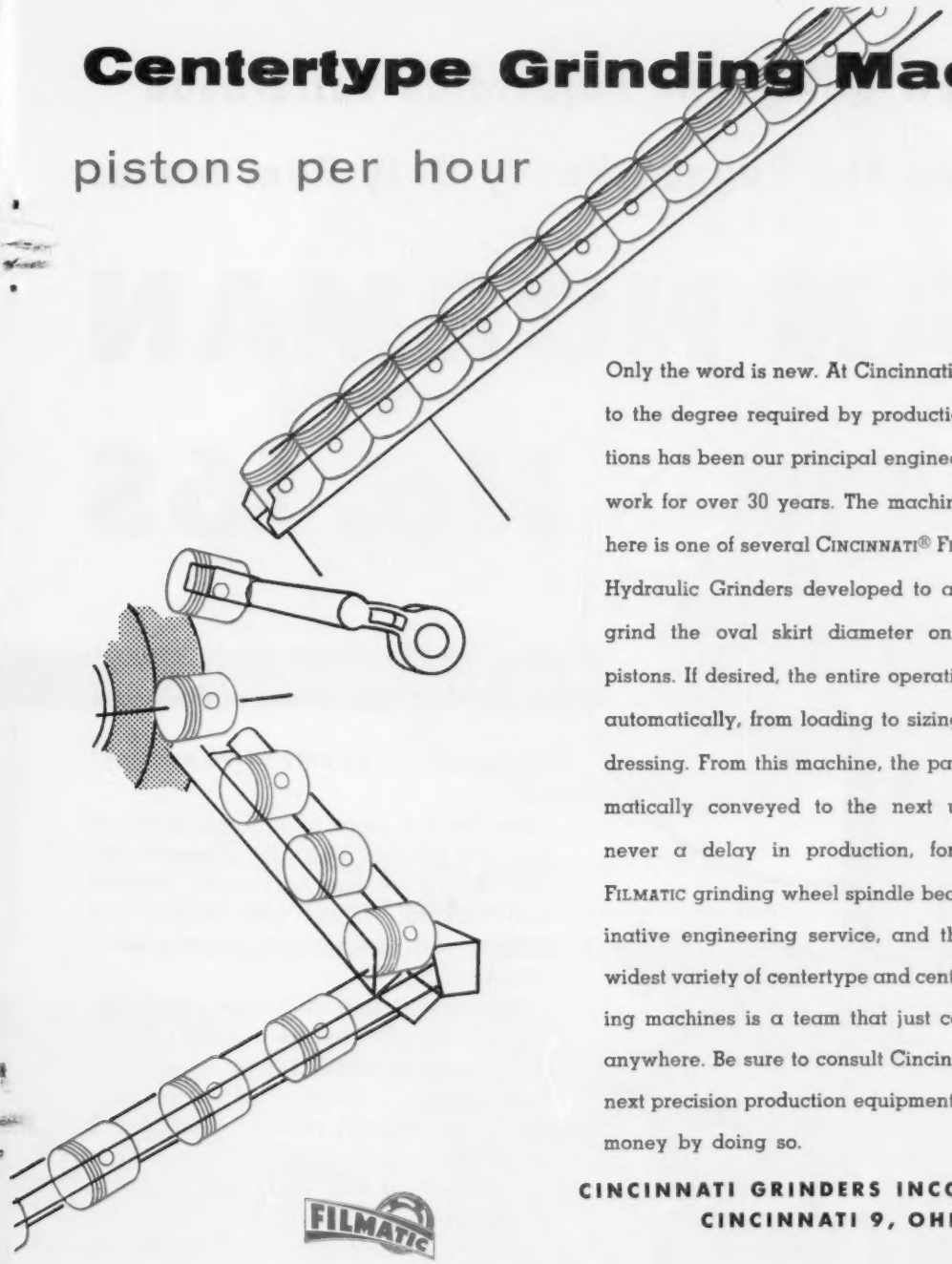


Oval skirt diameter is ground on 130 pistons per hour, on this CINCINNATI® FILMATIC Automatic Centertype Grinding Machine. Close-up shown below.



Centertype Grinding Machine

pistons per hour



Only the word is new. At Cincinnati, automation to the degree required by production specifications has been our principal engineering service work for over 30 years. The machine illustrated here is one of several CINCINNATI® FILMATIC Plain Hydraulic Grinders developed to automatically grind the oval skirt diameter on automotive pistons. If desired, the entire operation proceeds automatically, from loading to sizing and wheel dressing. From this machine, the parts are automatically conveyed to the next unit. There's never a delay in production, for CINCINNATI FILMATIC grinding wheel spindle bearings, imaginative engineering service, and the industry's widest variety of centertype and centerless grinding machines is a team that just can't be beat anywhere. Be sure to consult Cincinnati for your next precision production equipment. You'll save money by doing so.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

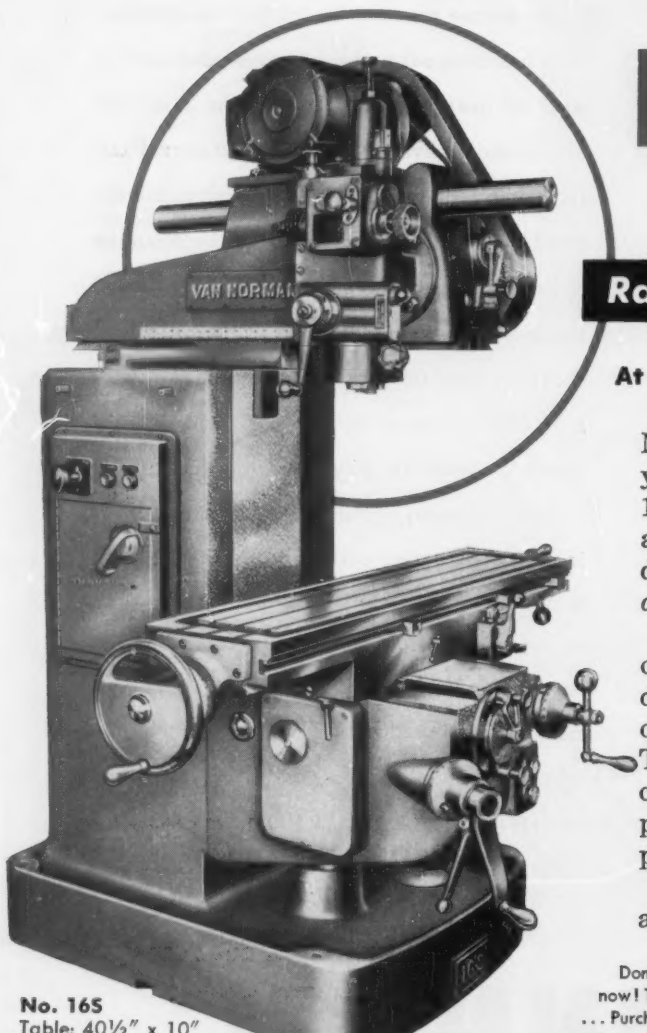
CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

For more information fill in page number on Inquiry Card, on page 255

This NEW Quill-Type Adjustable Cutterhead Mounted on the Rugged Heavy-Duty Ram makes

VAN NORMAN No. 16S



No. 16S
Table: 40½" x 10"
Quill Travel: 4"
Quill Power Feeds: .0015; .003; .006
Spindle Motor: 2 HP

Ram Type Miller...the most

At a cost to you of only $4.98 per day*

Now for the price of a single machine you can get this New Van Norman No. 16S that gives you horizontal, angular and vertical milling, *plus* boring and drilling with the same machine *without attachments.*

The new rugged quill-type adjustable cutterhead mounted on a rugged heavy duty movable ram increases the scope of operations . . . permits maximum cuts. The No. 16S will reduce overall work completion time . . . permits greater opportunities to cut costs and increase production.

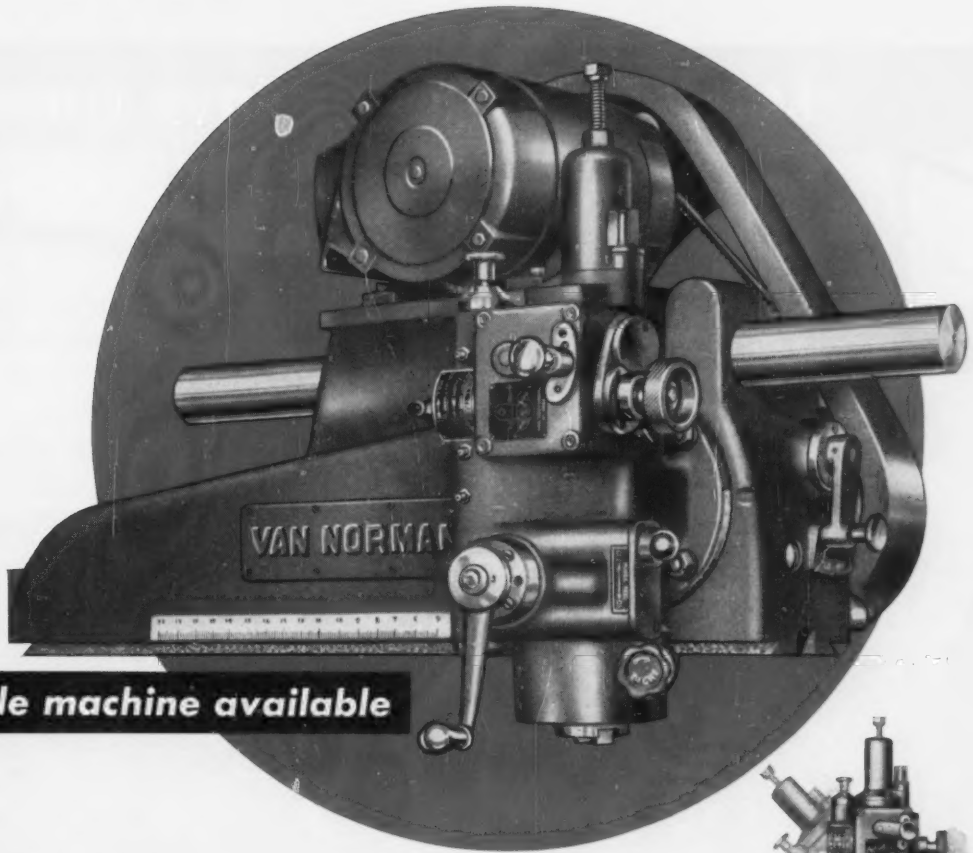
Write, phone or wire for information and catalog giving complete details.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy.

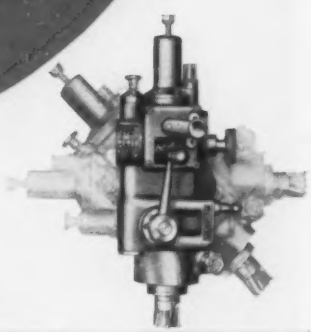
*Based on 5 year conditional sales contract. Lease and Conditional Sales Contracts not available to export.

VAN NORMAN MACHINE

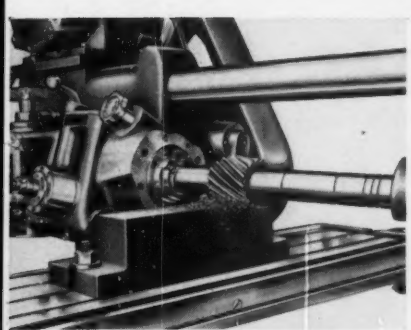
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



versatile machine available

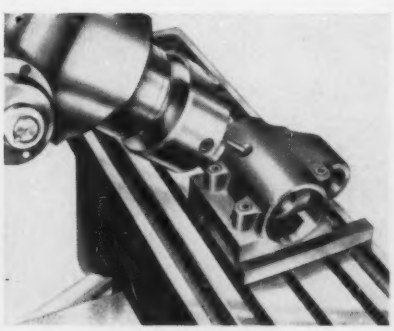


Adjustable Quill-Type Cutterhead Gives Workability of Two Single Purpose Machines PLUS Accurate Boring and Drilling



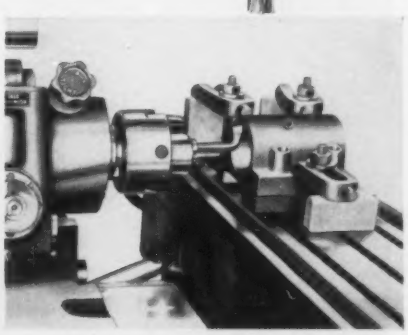
A HORIZONTAL MILLING

A horizontal milling cut performed on a cast iron base. Width of cut 2½″; Depth .25″; 3″ wide helical slab milling cutter.



ANGULAR BORING

Angular boring on a cast iron saddle bracket boring a 1″ dia. hole. Depth of bore 1¾″ removing ⅛″ stock on roughing cut. Finish cut removes .010″; Tolerance on I.D. .001″



HORIZONTAL COUNTER BORING

Horizontal counter boring operation of a 3″ dia. hole on same saddle bracket. Depth of cut 1″ to a shoulder removing approximately ⅛″ on rough cut. Finish cut .010″; tolerance on I.D. .001″.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

For more information fill in page number on Inquiry Card, on page 255

Landis universals save time for

10" x 24" Universal Cylindrical Grinder

LANDIS

precision grinders

toolrooms and small lot production

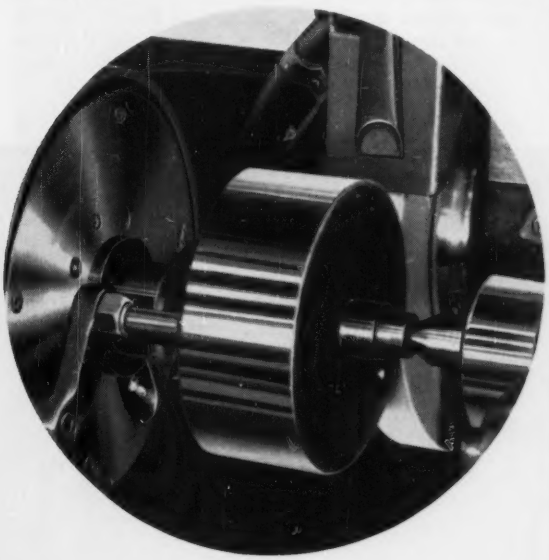
quick setups / hydraulic feeds

traverse grinding
infeed grinding
taper grinding
internal grinding
face grinding

condensed specifications

Maximum work swing	10¾″
Length between centers	24″
Diam. standard grinding wheel	12″
Wheel drive motor	1½ hp.
Work speed range	55 to 495 r.p.m.
Net weight, including elec. equip.	5,700 lbs.

Time saving internal grinding fixture of swinging bracket type gives quick changeover, from external to internal grinding.



Rigid construction gives fine finishes. Roll above was ground to 2 microinch finish.

Quick setup and operator convenience are assured through grouped controls at operator's position.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

UNCOVER THE HIDDEN PROFITS IN

with U.S. AUTOMATIC PRESS ROOM EQUIPMENT

on Display at Booth 375

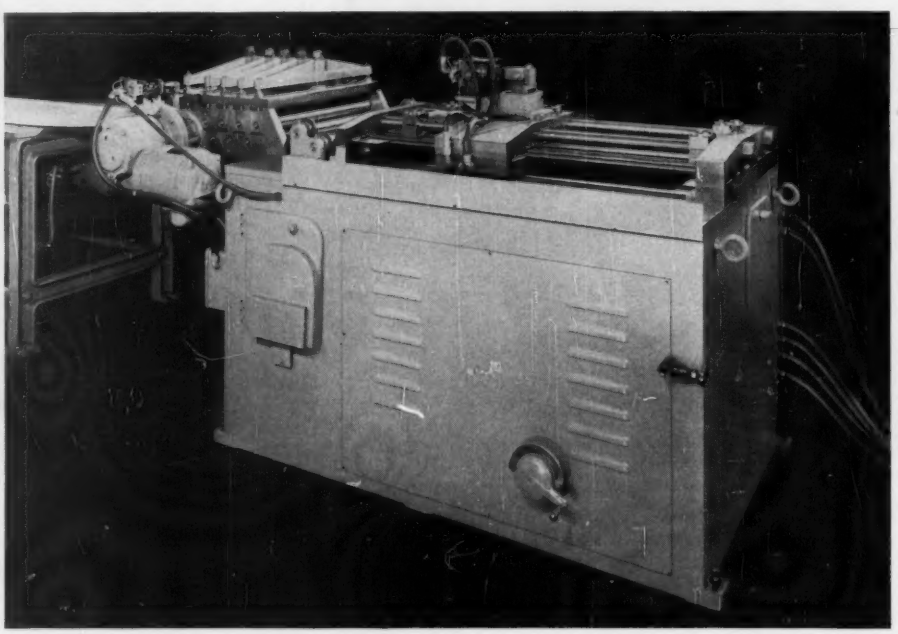
TOOL ENGINEERS INDUSTRIAL EXPOSITION

By converting your presses into automatic machines you are able to reduce piece part costs. You, like all other manufacturers, are interested in attaining this end result. The units illustrated are only a few of the different types of Feeds, Straighteners, Coil Cradles and Stock Reels included in our line. These and our other units have been designed and built with the end result of "Automatic Operation" in mind.

To keep pace with the requirements of stamping manufacturers, we will exhibit and demonstrate a number of completely new units in our Press Room Equipment line at the ASTE Industrial Exposition, International Amphitheatre, Chicago, Illinois, March 19-23, 1956.

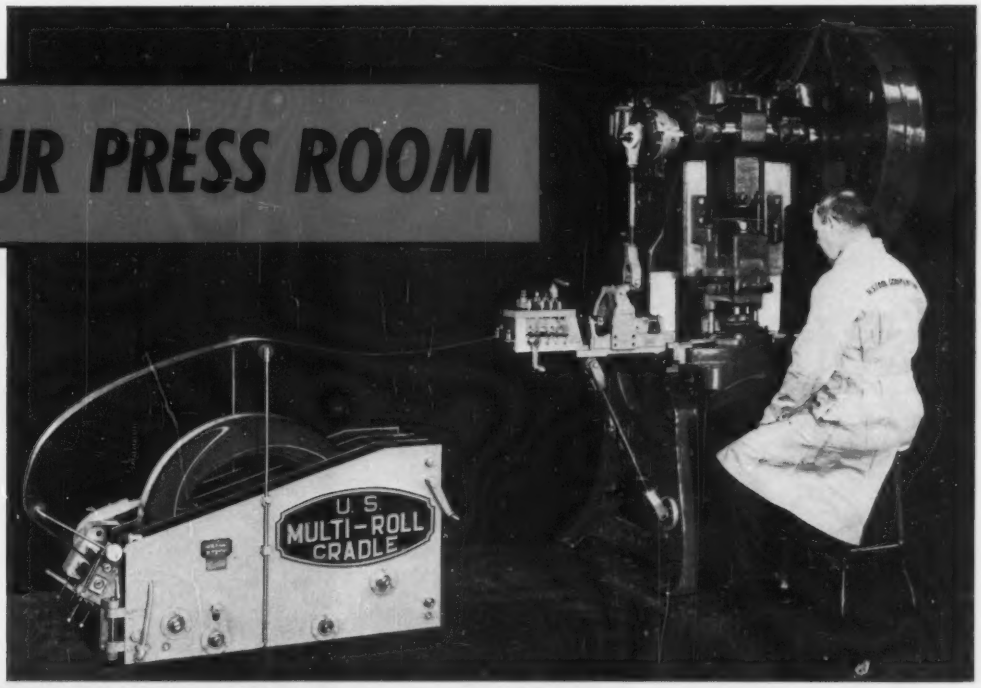
The use of this equipment gives you the double advantage of increased production and reduced labor costs, plus the feature of flexibility. Within their capacity, U. S. Slide Feeds can be easily adapted to handle materials varying in width, thickness and length of feed. Furthermore, U. S. Slide Feeds are designed so that the length of feed is controlled between positive stops providing consistent accuracy that is especially desirable in progressive die operations.

If you use presses in your production program, be sure to visit our Booth No. 375 at the Exposition. In the meantime, ask for a copy of our Bulletins No. 80-M and 90-M illustrating and describing U. S. Automatic Press Room Equipment.

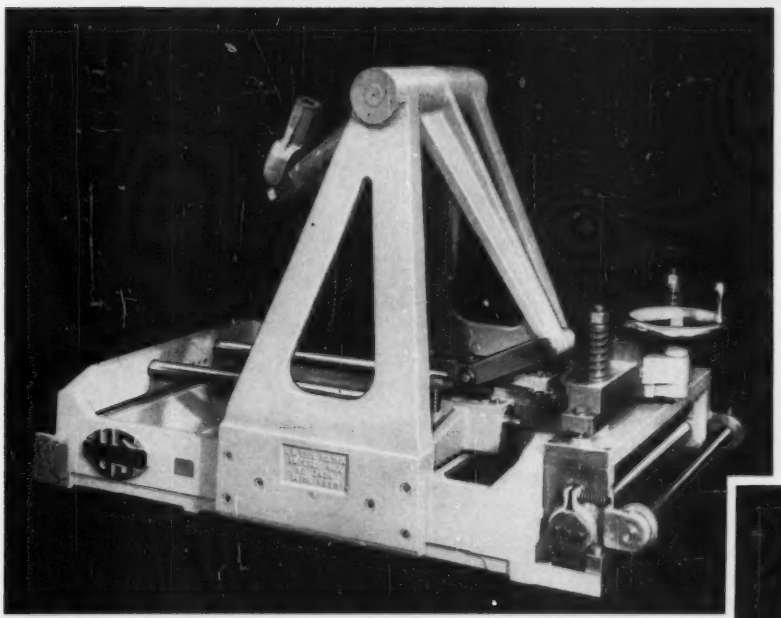


SFC-24-24 U. S. Cabinet Mounted Individually Motor Driven Slide Feed capable of handling material up to 24 inches in width, with feed length adjustable up to a maximum of 24 inches at one stroke. Equipped with Stock Straightener with a pair of motor driven take-in rolls suitable for material up to .060 in thickness. This feed can be cycled to obtain feed lengths over 24 inches.

YOUR PRESS ROOM



U. S. Slide Feed, Plain Straightener, and U. S. Multi-Roll Cradle used in conjunction with conventional O.B.I. Press.



Smallest and largest sizes of U. S. Slide Feeds which we now build. Above, Model SF-24-24 capable of handling material up to 24 inches in width, with feed length adjustable up to a maximum of 24 inches. To the right, Model SF-00 capable of handling material up to 1½ inches in width with feed length adjustable up to a maximum of 1 inch.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

For more information fill in page number on Inquiry Card, on page 253

5 great machines... 1 big objective...

to cut your lapping costs

Here they are. Five outstanding lapping machines by Norton. Designed for single or multi-purpose — but all built to give you fastest, cleanest lapping performance at lowest possible operating cost.

Every second of operation, value is being added to the product through a finer, smoother, precise finish achieved in less time. This adds to your profit margin and to the ultimate user's satisfaction.

Whatever your needs there is the right Norton Lapping Machine to give you maximum output, minimum downtime; higher quality work and less dependence on manual skills.

Send for more complete information or submit samples of your work for correct lapping machine application and production. NORTON COMPANY, Machine Division, Worcester 6, Mass.

***To Economize, Modernize With* NEW**

NORTON

GRINDERS *and* LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
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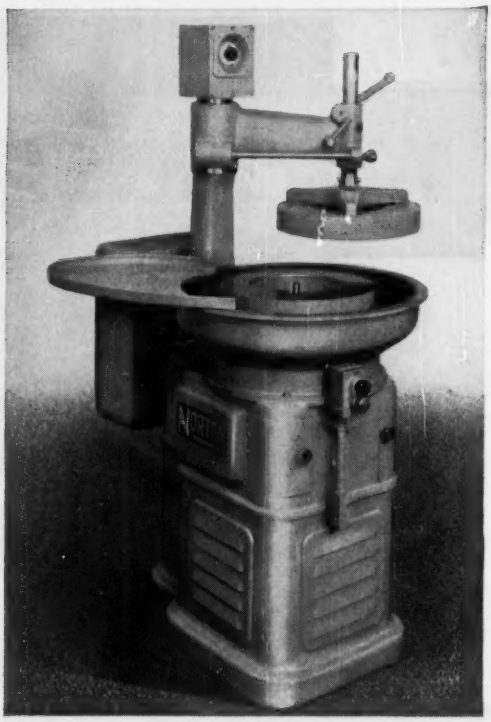
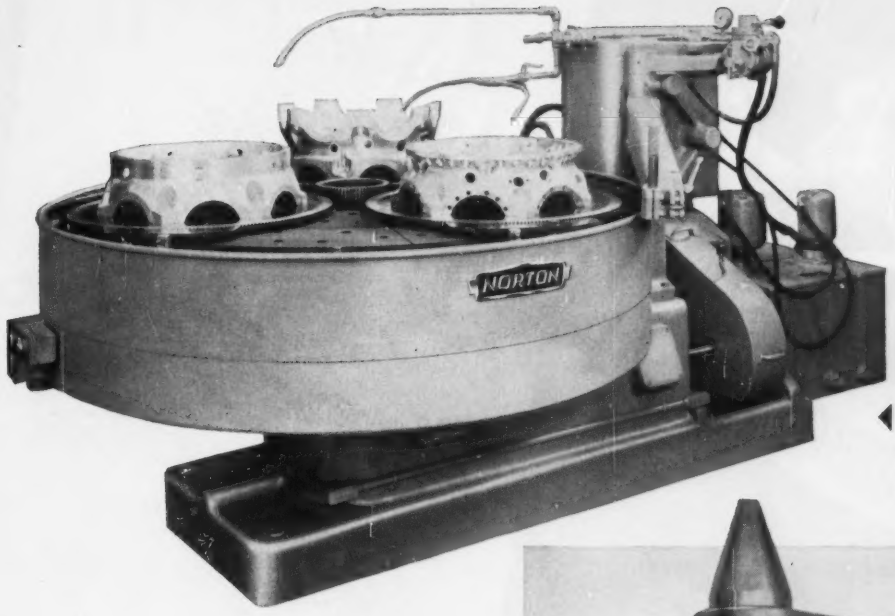


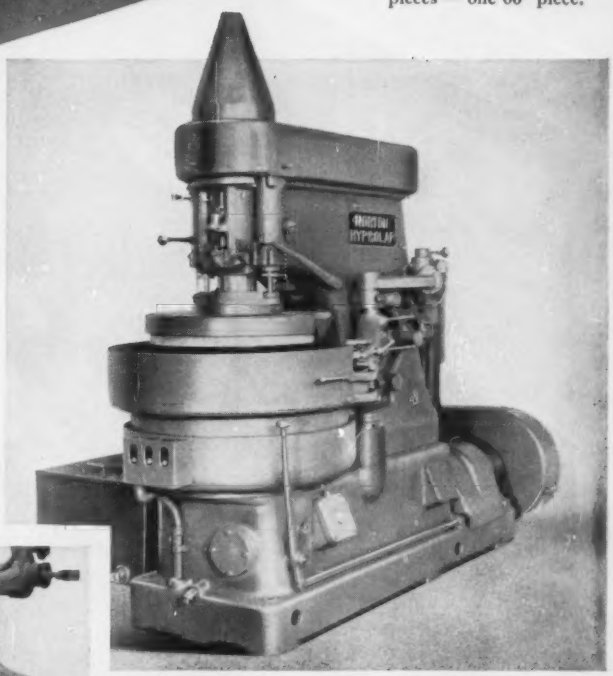
Vertical lapping machine type 16FC has outstanding production capacity in such work as diesel injector parts, plug gages, size blocks, the sides of rings, and rollers. It produces flat or cylindrical work to a high degree of dimensional accuracy, parallelism and finish. Work capacity: 3″ x 5″ flat and 3″ diameter cylindrical.

Simplex surface finisher No. 12. A highly efficient machine which uses flexible coated abrasives. Ideal for handling small crankshafts for refrigerator compressors and outboard motors, eccentric and concentric cylindrical surfaces, journals and seal surfaces on many cylindrical parts. Work capacity: ½″ to 2½″ diameter; up to 12″ length.

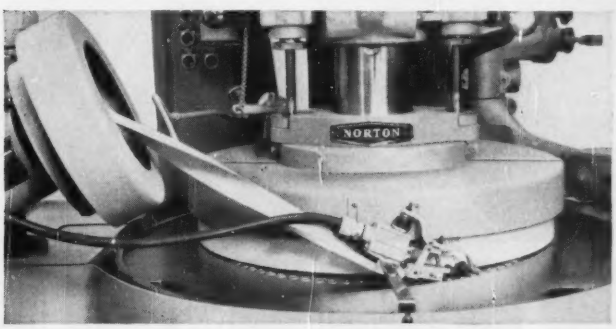


60" single face flat lapping machine. Bonded abrasive laps make it a sensational performer, particularly on soft metals. It produces a clean finished surface free from imbedded grit. Provides seal surfaces, wear surfaces or flat surfaces for other machining operations. Hydraulic pressure device is available for light work; power-operated truing arm, loadless starting inertia-delay clutch. Capacity range, three 24" pieces — one 60" piece.

Hyprolap lapper No. 26. Extremely fast-cutting machine using bonded abrasive laps and filtered coolant. Finishes 20 or more work pieces simultaneously with a combination of accuracy and finish-uniformity otherwise unobtainable in mass production. Easy to operate. Lapping pressure is hydraulic powered and controlled — an exclusive Norton feature. Work capacity up to 3" thickness or diameter, to 7½" length.



Through-feed No. 26 Hyprolap machine. 4-to-1 savings proved on finishing small, flat parts. Handles small pieces up to 8,000 an hour. Loading and unloading are entirely automatic . . . less downtime for lap dressing because work path traverses the entire work surface of each lap. High worker skills are not needed. Work up to 1¼" diameter. Modifications to handle larger work.



NORTON JOB LAPPING SERVICE

Improve your product quality by precision lapping. The new enlarged Norton Job Lapping Department is ready to finish parts to your exact specifications. Complete and modern in every detail, the new department is manned by personnel skilled in every type of lapping process. Jobs handled include flatwork up to 24" across and cylindrical work from 1/16" diameter by ½" long to 2" diameter by 8" long, in practically every material. The best type of lapping for your requirements — with rapid stock removal and highest precision finishes — can be produced. See your Norton Representative for details, or write us direct.

For more information fill in page number on Inquiry Card, on page 235

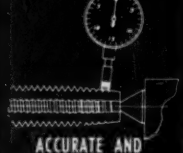
WINTER

Taps with Balanced Action— give you the latest mechanical and technical advances in design and manufacture. All Winter Taps give Balanced Action performance.

EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS



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WINTER BROTHERS COMPANY Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York
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NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, MICH., U.S.A.

National

A search that never ends—

In National's testing laboratories, better ways to cut metal are constantly sought. Many have been found, and used to improve the performance of National Tools

Twist Drills • Counterbores
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CALL YOUR NATIONAL DISTRIBUTOR

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Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Cleveland Chicago • Dallas • San Francisco • Los Angeles

NIAGARA FRONT-TO-BACK

ALL NEW rugged, front-to-back crankshaft with huge crankpins
ALL NEW compact, fully concealed driving mechanism
ALL NEW enclosed, rigidly supported gearing in sealed oil bath
ALL NEW electro-pneumatic friction clutch on crankshaft
ALL NEW wider spaced, longer, narrower gibs
ALL NEW wider, box type slide all within gibbing
ALL NEW precision, hardened, longer-wearing gears
ALL NEW compact, straight-line, space-saving frame

Hailed as the greatest achievement in modern OBI press design and performance, by over 100,000 spectators who examined this mechanical marvel at the Machine Tool Show, the all-new Niagara Series E, Single Point, Open Back Inclinable Press starts a brand new chapter in press history.

It's years ahead of any OBI ever built. It's an industrial revolution all by itself. No other press, in modern times, embraces so many "All-New" features.

Gone are exposed, overhanging gears, flywheel and other mechanisms. Gone is excessive and damaging crankshaft deflection. Here to stay are: Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide, with minimized tendency to cock. Substantially increased die life. Longer lasting, hardened gears. Smoother, safer press performance. Smaller floorspace requirements.

Built in 4 sizes, with shaft diameters from 4½ to 7½ inches and capacities from 75 to 200 tons, the new Series E is available in both standard models and automation models equipped with the most advanced controls and devices for peak production. A complete description of both, with full specifications, is given in new Bulletin 56, sent promptly on request.

SEND FOR NEW BULLETIN . . .

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

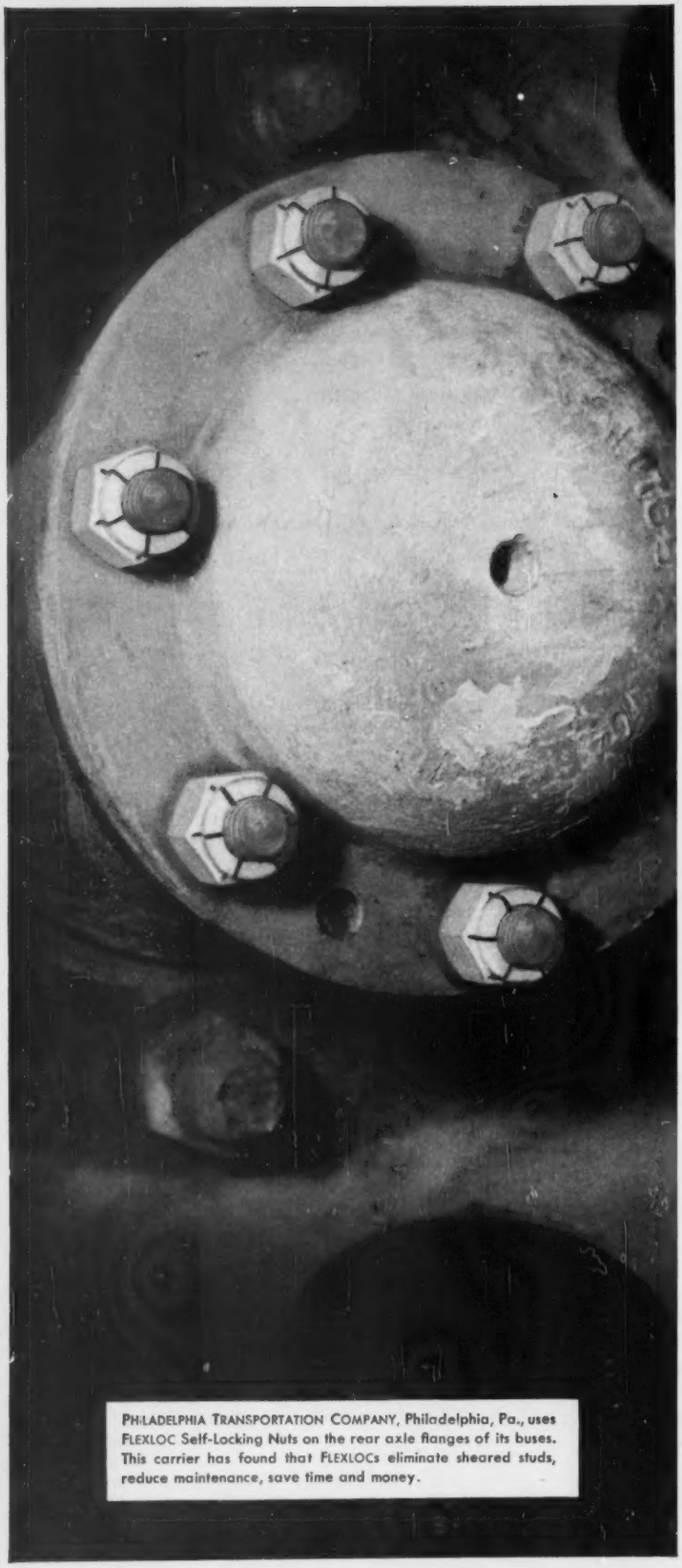
Dealers in principal U. S. cities and major foreign countries.

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work.

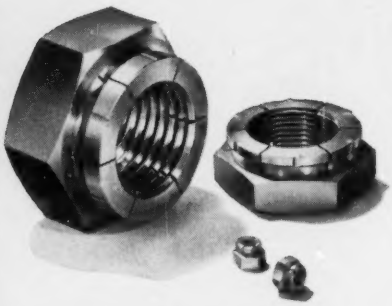
CRANKSHAFT OBI PRESS DESIGN

STANDARD DESIGN
For General Purpose Production

MODIFIED DESIGN
For Automation Lines



PHILADELPHIA TRANSPORTATION COMPANY, Philadelphia, Pa., uses FLEXLOC Self-Locking Nuts on the rear axle flanges of its buses. This carrier has found that FLEXLOCs eliminate sheared studs, reduce maintenance, save time and money.



How FLEXLOC locknuts work

FLEXLOCs lock and stay put on a threaded member regardless of the vibration encountered. Here's how they work. The slotted top or locking section is divided into six equal, flexible segments, closed in to make the inside diameter of the nut smaller than that of the companion bolt. When the FLEXLOC is applied, these are expanded by the bolt. The spring tension of the resilient segments locks the nut securely at any desired position on the bolt once the locking threads are fully engaged.

FLEXLOCs can be used over and over again. When expanded by the bolt, the locking section remains within the elastic limit of the metal. This permits the locking segments to return to their normal position, ready for reapplication to the bolt.

FLEXLOCs are one piece, all metal—nothing to assemble, come apart, lose or forget. They can be delivered in any quantity in a wide range of sizes. Stocks are carried by industrial distributors everywhere. Write for literature and samples. SPS, Jenkintown 19, Pa.

See us at Booth 479—ASTE Show

FLEXLOC®

LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.

SPS

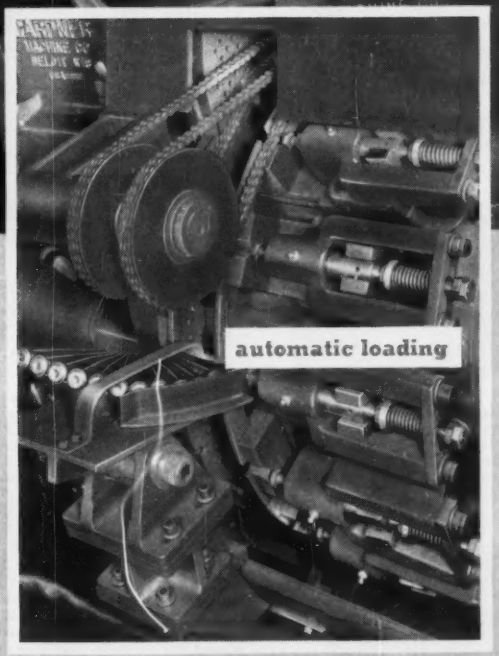
JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 255

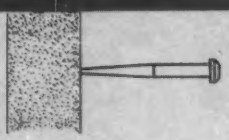
Semi-Automatic Gardner Disc Grinder

Grinds 1500 Spindle Ends Per Hour

automatic unloading



automatic loading



work data	
MACHINE	Gardner No. 122-23" Single Spindle Grinder.
PART	Cotton picker spindle.
PRODUCTION	1500 per hour.
STOCK REMOVAL	5/16" maximum.
TOLERANCE	.004" for uniformity.
TOOLING	Vee-notched rotary work carrier with gravity-type magazine feed and double chain hold-down.
ABRASIVE	Gardner Yellow Rim Wire-Lokt Disc.

GARDNER

precision disc grinders

BELOIT, WISCONSIN

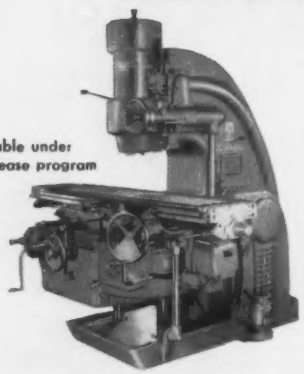
134M

Now Kearney & Trecker has

TF Series milling machines — front-mounted for faster table settings... positioned to prevent costly errors

Standard equipment on new

Available under Tool-Lease program



TF Series Model 550 Vertical Milling Machine

POWER — 50/25 spindle drive; 5hp feed and rapid traverse drive
TABLE WORKING SURFACE — 96" x 18"
FEEDS — (32) 3/8" to 90"
SPEEDS — (16) single-speed, (32) two-speed
WEIGHT — 17,600 lbs.

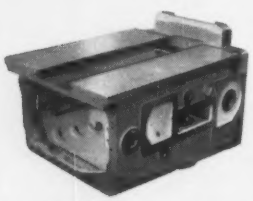
THE front-mounted table handwheel is a standard feature on all Kearney & Trecker new TF Series, knee-type milling machines — Plain, Universal and Vertical. Mounted on the right front of the saddle and projecting diagonally, the newly positioned handwheel is a part of Kearney & Trecker's up-front central control grouping.

Because the handwheel is ideally located so as to simplify operation of the machine, the operator makes table settings more accurately — in less time and without leaving his normal operating position. It measurably reduces operator fatigue.

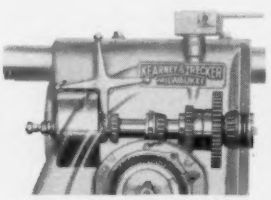
In addition, the new TF's give you a combination of more outstanding design and operating features (illustrated below) than any other knee-type milling machine on the market today. They're available in five sizes — No. 2 to No. 6 from 10hp to 50hp.

For complete specifications, and what these TF's can do for you, see your nearest Kearney & Trecker representative, or write direct to Kearney & Trecker Corp., Milwaukee 14, Wisconsin.

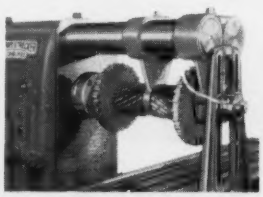
5 more reasons why TF Series milling machines are so easy to operate



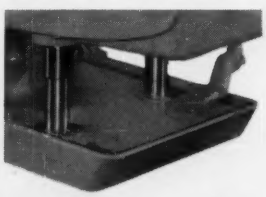
Heavier, Wider, One-Piece Knee — The *Twin Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, fly-wheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.



Double "Vibra-Void" Overarms — Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection. Design also greatly simplifies changing of arbors and cutters.



Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of the new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

Title.....

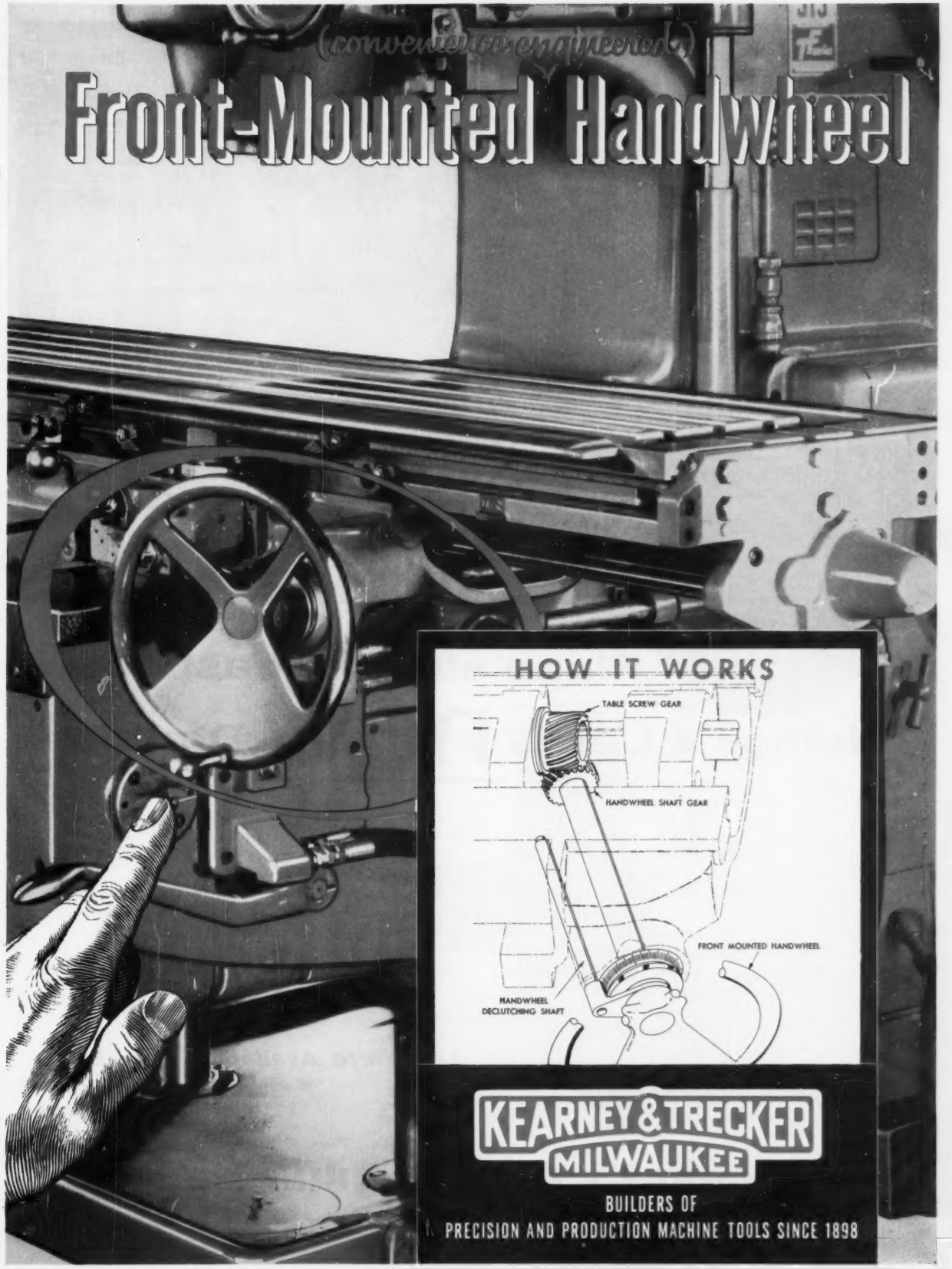
Company.....

Address.....

City..... Zone..... State.....

(convenience engineered)

Front-Mounted Handwheel



KEARNEY & TRECKER
MILWAUKEE

BUILDERS OF
PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

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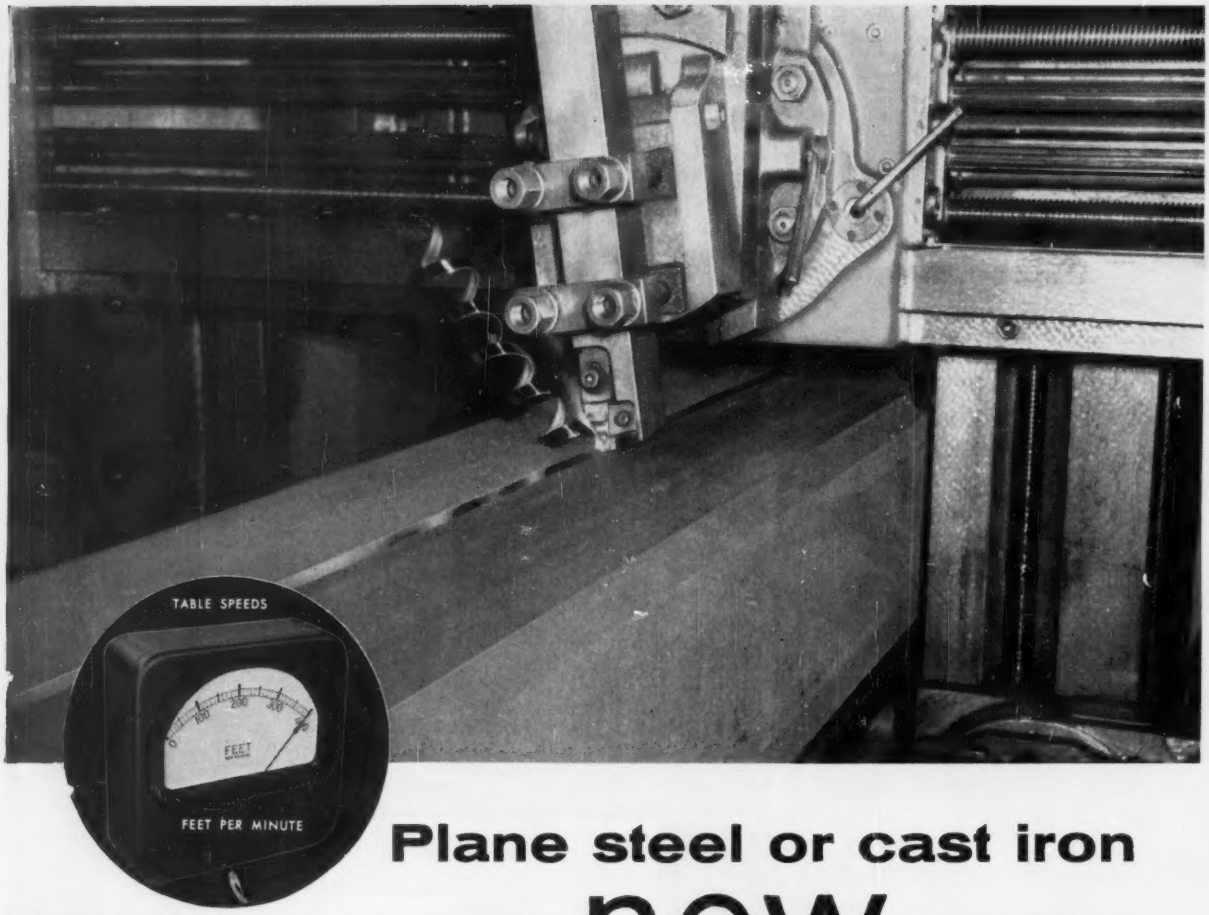


Plane steel or cast iron Giddings & Lewis new Double

AT tool speed of 400 feet per minute, steel or cast iron chips literally "ZIP" off the workpiece. With speeds like this, you can double present-day production with Giddings & Lewis' new Hypro Double Housing Planers.

Now for the first time anywhere, G&L Hypro advanced-design planers offer table speeds ranging from 25 to 400 feet per minute . . . permitting you to take full advantage of the greater productivity of tungsten-carbide or other high-speed cutting tools. In addition, these machines have exceptional ability to maintain precise tolerances under the most severe cutting pressures.

Outstanding features of the machine include: dual saddle and slide controls; power cross-feed to side heads; extra-heavy cross-rail; electric rail clamp; twin-helical table drive gearing; extra-high pneumatic tool lifters on both rail and side heads; hydraulic table stops and jacks, and new design heavy box-section housings. You get 100% table support for added strength and machining accuracy, thanks to massive construction of the full double-length bed.

Giddings & Lewis adjustable voltage motor-generator set and the double-capacity table drive motor provide fast acceleration, deceleration and reversing — plus maximum power for short stroke planing operations.

For complete specifications and features, see your nearest G&L representative, or write direct to Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin.

Literature Available:

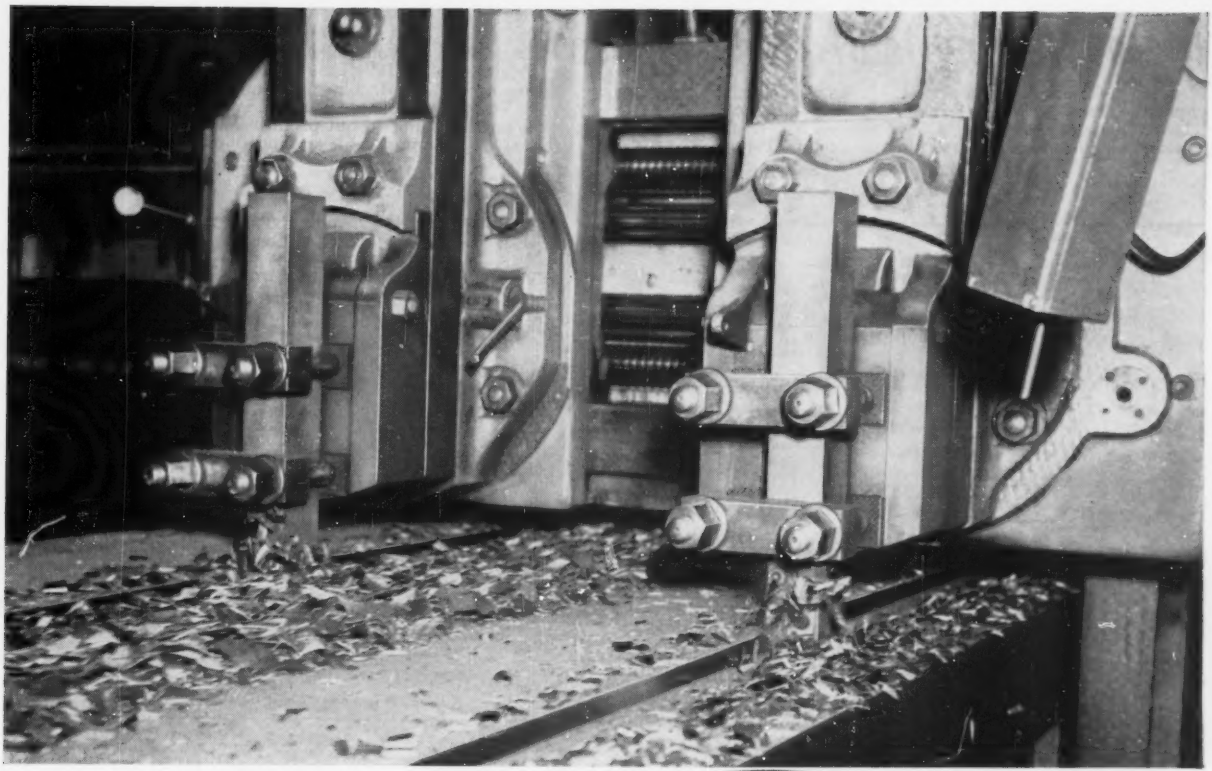
Ask for Bulletin No. 250 with details on new Hypro Double Housing Planers.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

G-56



at 400 FPM with Housing Planers

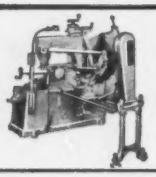
Here's carbide planing of steel and cast iron at 400 feet per minute. Both rail heads are equipped with Davis Shear Angle Clamped-on carbide insert planer tools.

Metal Sawing is of many types

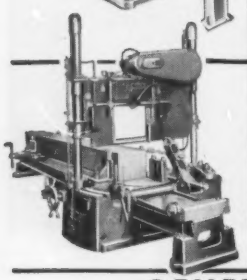
Requiring, for efficiency, sawing machines of varying characteristics, capacities, feed pressures, speeds . . . even different blade actions. The complete MARVEL Line comprises various basic types of metal sawing machines to meet the requirements of all shops.

Engineered to your jobs by a MARVEL Sawing Engineer, a MARVEL Saw is certain to lower your sawing costs (both blade cost and cost per piece); to cut-off more accurately (both in length and squareness) and to out-produce any other sawing machine of comparable specifications.

PRODUCTION HACK SAWS

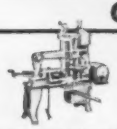


TYPE	CAPACITY	MODEL	GENERAL APPLICATION
HACK SAW Single Cut	6″ x 6″	No. 6	These machines embody all of the modern design features of fine machine tools. They are recommended for constant heavy duty service, cutting all types of machinable metals. They should be selected whenever the work demands speed, accuracy, and stamina.
	10″ x 10″	No. 9	
HACK SAW Automatic Bar Feed	6″ x 6″	No. 6A	These automatic MARVEL saws use the No. 6 and No. 9 as a basic unit, but are modified to include an automatic mechanical bar feeding mechanism. Their purpose is to automatically "cut-up" long bars into multiple short length pieces without constant attention of an operator.
	10″ x 10″	No. 9A	
HACK SAW Dual Bar Feed	10″ x 10″	No.9A3	The No. 9A3 machine combines full automatic operation and manually controlled power bar feed, the latter for lengths beyond practicability of full automatic operation.



HACK SAW Hydraulic Roll Stroke Single Cut	18″ x 18″	No. 18	These big saws are proof that the hack saw method is the most practical for cutting off big pieces of the toughest steels. Low investment, economical operating and maintenance cost, accuracy and cutting speed make these machines an ideal tool for the steel mill, warehouse and forge shop.
	24″ x 24″	No. 24	
HACK SAW Power Work Handling Type	18″ x 18″	No.18B	The No. 18-B is a special structural saw, primarily designed to obtain accuracy to such a degree in cutting structural shapes that subsequent face milling is not required.

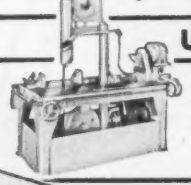
GENERAL PURPOSE HACK SAWS



TYPE	CAPACITY	MODEL	
HACK SAW Single Cut	6″ x 6″	No. 4B	This saw is fast, accurate, yet moderately priced. For intermittent service, to cut off all types and shapes of machineable metal. Recommended for use in the tool room, maintenance department, and machine shop.

HACK SAW Single Dry Cut	4″ x 4″	No. 1	The most popular mechanical saws on the market for occasional cut-off work. Sturdily built, easy to operate, low in price, they are ideal for the small shop where speed is not essential.
	6″ x 6″	No. 2	

UNIVERSAL BAND SAW

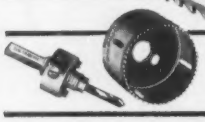


TYPE	CAPACITY	MODEL	
BAND SAW	18″ x 18″	No. 8	The MARVEL No. 8 Band Saw is designed primarily for universal work. It will trim, miter, notch and cut-off bar stock, pipe, structural sections, mouldings and tubing. No other saw of any type is capable of handling the wide range of unusual cutting jobs possible on this very versatile machine.

HACK SAW BLADES—*High-Speed-Edge*

COMPOSITE UNBREAKABLE

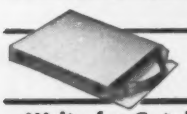
The original composite blade with a fast-cutting, long-lasting high speed steel cutting edge integrally welded to a tough, non-breakable alloy steel body. These superior blades improve the efficiency of ANY hack saw machine because they will withstand heavier feed pressure, higher tension, and faster speeds. A type and size for every hack saw, for every machineable material.



HOLE SAWS—*High-Speed-Edge*

HEAVY DUTY FOR MACHINE TOOLS

Permit sawing-out of large holes (to 4½″ dia.) in steel plate (to 1¼″ thickness) with small capacity machine tools and portable tools. Heavy duty arbors and 1-piece floating, self-aligning, High-Speed-Edge saws. This new type hole saw, developed by MARVEL, provides a fast, low-cost method for making large holes, an operation previously requiring much machining or large equipment.



BAND SAW BLADES

WELDED TO SIZE INDIVIDUALLY PACKAGED

Through exhaustive tests MARVEL has determined the type of set—raker or wavy—best suited for all-around cutting on every standard make and model metal band saw. These exactly suited blades come welded to size, ready for use, and individually packaged.

Write for Catalog

ARMSTRONG-BLUM MFG. CO.

5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

Metal Cutting MARVEL SAWS

Better Machines—Better Blades

WHY GROWL . . .

. . . OVER YOUR GRINDING WHEEL PROBLEMS? You'll solve them easily when you switch to CINCINNATI (PD)° GRINDING WHEELS. Because *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—the most talked about development in years. Positive Duplication is a remarkable achievement in precision manufacturing and quality control that can *save you money . . . and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels.

Let us sink our teeth into your grinding wheel problems, and we'll have you purring like a kitten. Contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

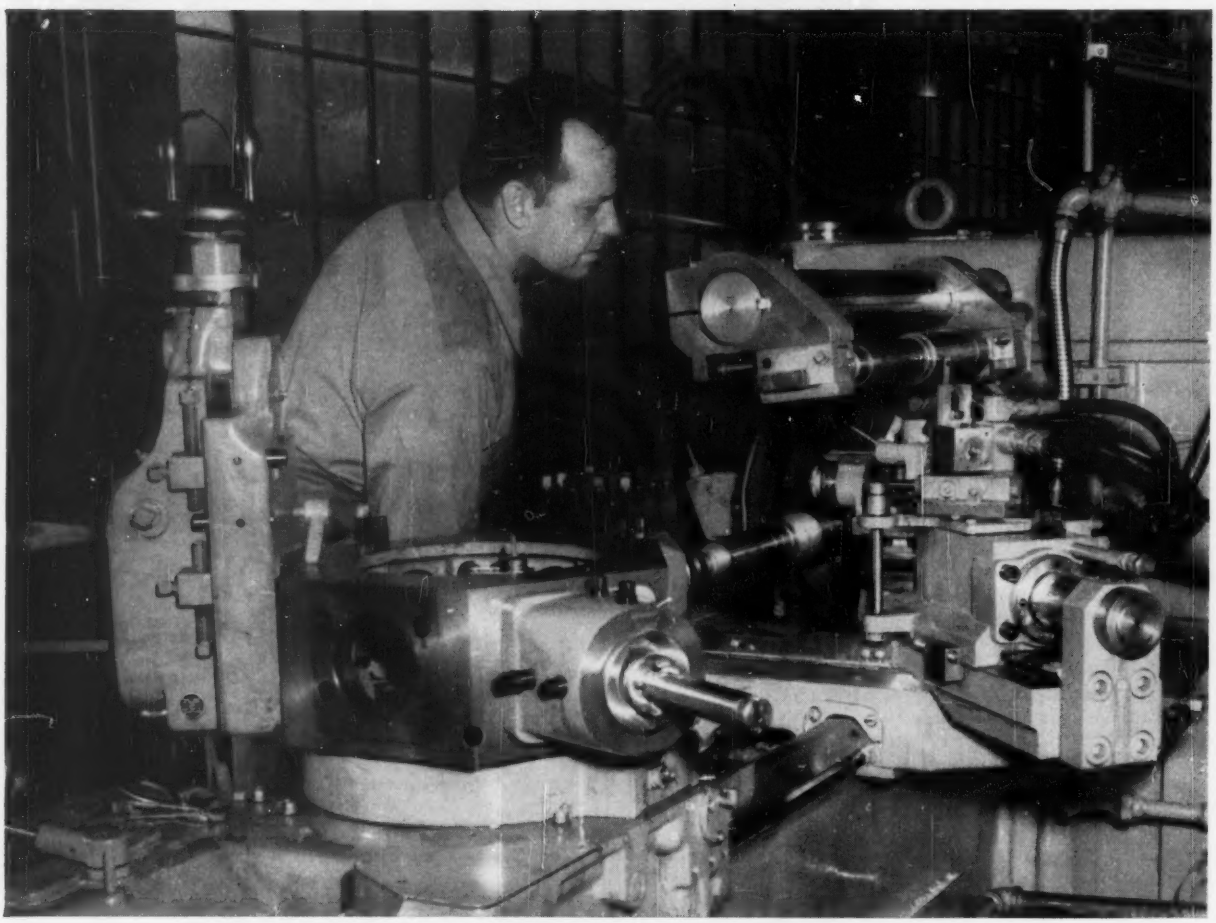
Remember . . . *only* CINCINNATI Grinding Wheels give you . . . (PD) POSITIVE DUPLICATION.

CINCINNATI° *Grinding Wheels*

A Production-Proved Product of THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

Warner & Swasey with
DOES FULL DAY'S WORK



J. S. COFFIN, JR. COMPANY, Englewood, N. J. accomplished this startling time reduction on the 45" pump shaft, shown above. They transferred it from a fairly new standard turret lathe to a 2-A Extra Heavy Duty Turret Lathe equipped with Warner & Swasey's new Contour Unit.

This shaft, for their boiler feed pumps, has 19 different diameters, with as little as .010" difference between some adjacent diameters. It also has a taper and four Class 3 threads. Previously, it required 7 hours of machining on a standard turret lathe, using accepted turret lathe practice—indicating the money-saving advantages of this new Warner & Swasey Contour Unit.

Now the shaft is quickly cut down from 3¼" bar stock to finished diameters ranging between 1⅜" to 2⅞" using the separate rough and finish cutters in the hydraulically-operated unit's turret. It is roughed out with two and three cuts using the same cutter by simply flipping the tracer unit's leaf stops. A finish cut is then taken over the entire length of the shaft. From start to finish—only 66 minutes, including many other conventional cuts!

This unique contour unit also machines the intricate stainless steel diaphragm shown, providing Coffin similar time savings.

Operators like the unit's fast setup, and the overall ease of machine handling that results from the

new contour unit

IN 66 MINUTES!

Machines both bar and chucking jobs!

STAINLESS STEEL DIAPHRAGM, 12 1/16" diam. and 2 25/32" thick, has intricate surfaces requiring fine finishes—all machined on the contour unit.

45" PUMP SHAFT, made of .50 carbon steel, has all its 19 diameters roughed and finished by contour unit.

2-A's automatic head shifting. After pre-selecting his speeds, and pushing the master lever, an operator can position tools for the next cut while the head automatically shifts.

This story shows the time and money-saving possibilities this new, versatile combination of turret lathe and contour unit opens for you. For the complete facts on how it can cut costs for you, call in your Warner & Swasey Field Representative.

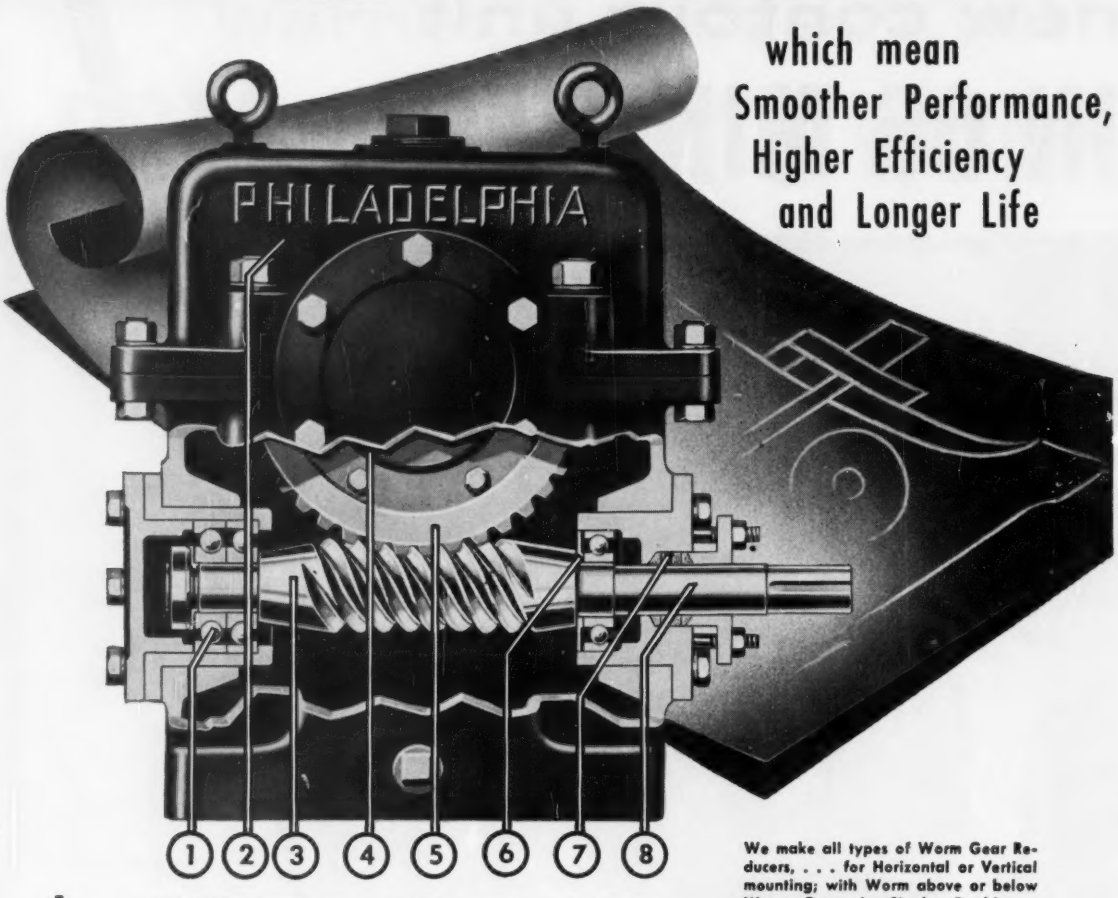
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 255

YOU GET ALL THESE ADVANTAGES...

which mean Smoother Performance, Higher Efficiency and Longer Life



1____ **BEARINGS** throughout are of highest quality, calculated to take all loads and stresses in accordance with maximum ratings of units.

2____ **EXCEPTIONALLY RIGID HOUSING** of best grade cast iron . . . Strengthening ribs integral with design.

3____ **WORMS** made of SAE 3115 Steel with carburized and hardened threads. Shaft and threads smoothly ground after hardening.

4____ **GEAR SHAFT BEARINGS** run in an oil well that automatically fills with fresh oil when filled from top. Splash from the gear keeps the wells filled to the overflow point.

5____ **WORM GEAR** made from quality chill cast nickel bronze bolted to a semi-steel center. (Smaller sizes are solid bronze.)

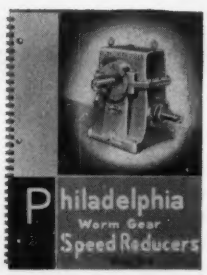
6____ **WORM AND WORM BEARINGS** run in oil bath. Baffle plates prevent flooding.

7____ **WORM SHAFT** equipped with stuffing box to prevent oil leakage.

8____ **SHAFTS** are premium quality. Always accurate, straight, concentric.

We make all types of Worm Gear Reducers, . . . for Horizontal or Vertical mounting; with Worm above or below Worm Gear; in Single, Double or Triple Reductions for medium or heavy duty service; any horsepower or reduction ratio.

Tell us your Speed Reduction problems, and a Philadelphia Sales Engineer will gladly call upon you, . . . without obligation.



Catalog WG-51 sent upon request on your letterhead.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.

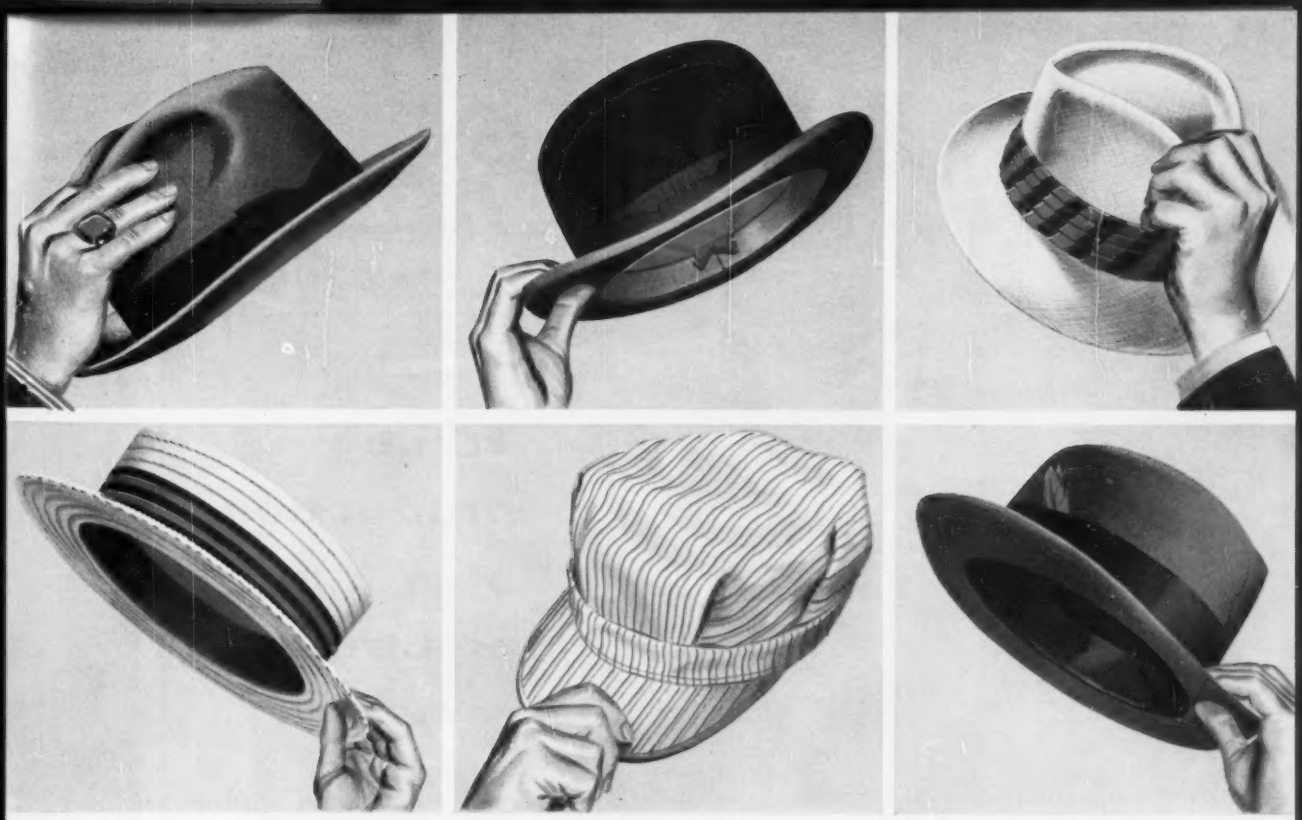
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
Virginia Gear & Machine Corp. • Lynchburg, Va.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892

For more information fill in page number on Inquiry Card, on page 255



Why hats are off to CIMCOOL...

... because CIMCOOL° has become, in just a few years, the largest selling cutting fluid in the world. And sales of this radically new and different coolant are continuing to climb because CIMCOOL Standard Concentrate has two big advantages over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We'll be happy to supply information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll have one of our Cincinnati Milling-trained machinists call on you —without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

Printing electronic resistors at Barry Process Company, Brooklyn, New York, with Denison hydraulic Multipress and special patented head.

Cost-saving idea from ***DENISON***

Triples production of printing electronic resistors

ELECTRONIC circuits are printed three times as fast with the Denison hydraulic Multipress®.

Uniformity of carbon ink deposits holds tolerances within 6% on resistors ranging from 100 ohms to 2 megohms.

Critical timing and pressure control, essential for precise duplication of ink deposits, are easily attained with the Denison split-second time-hold delay and precision controlled pressure on the hydraulic ram.

Exceptionally fast set-up of die platens enables efficient handling of a wide range of work with minimum of setup, for low-cost production of many types of printed electronic circuits.

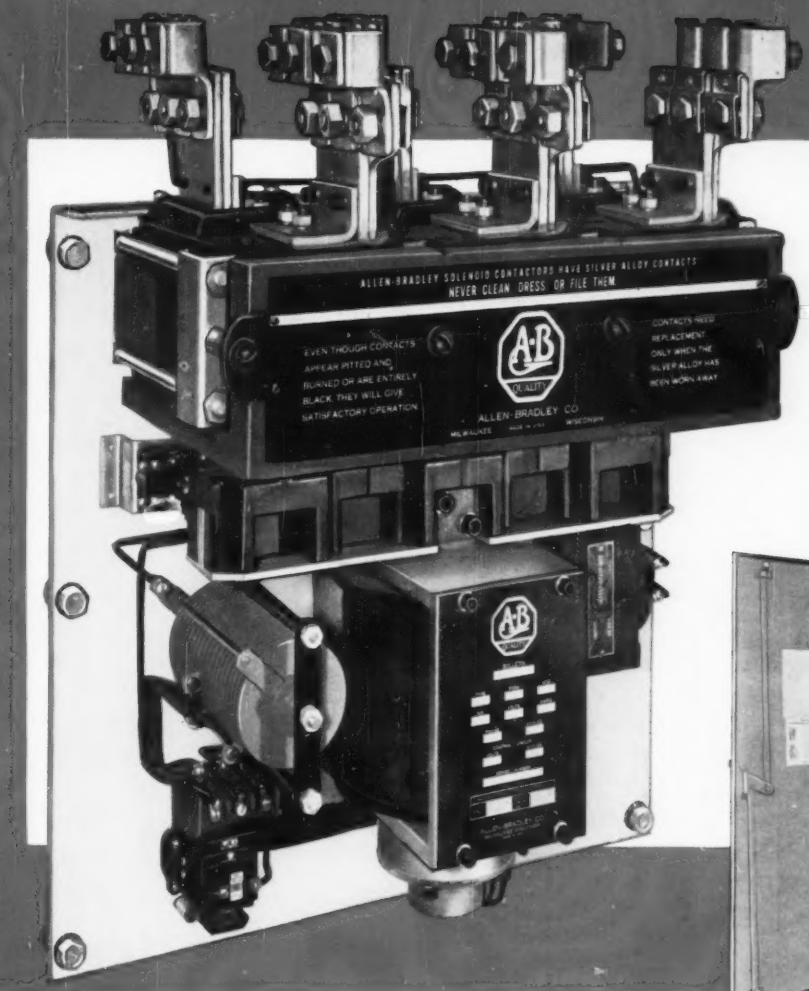
Have the Denison representative give you more cost-saving details. He can also show you how to save money on jobs like swaging, staking, riveting, deep drawing and assembling. Write us.

THE DENISON ENGINEERING COMPANY
1244 Dublin Road, Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.

DENISON Hydr-OIL-ics

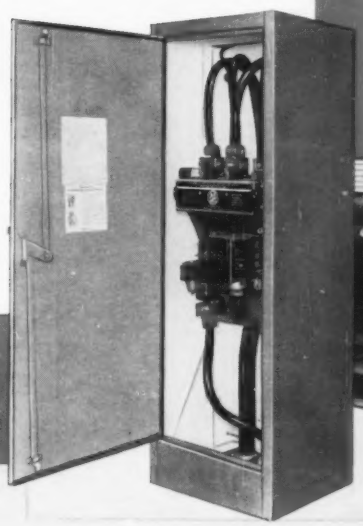
HYDRAULIC PRESSES • PUMPS
MOTORS • CONTROLS

For more information fill in page number on Inquiry Card, on page 255


ALLEN-BRADLEY SOLENOID CONTACTORS HAVE SILVER ALLOY CONTACTS
NEVER CLEAN DRESS OR FILE THEM
EVEN THOUGH CONTACTS APPEAR PITTED AND BURNED OR ARE ENTIRELY BLACK, THEY WILL GIVE SATISFACTORY OPERATION
A-B
QUALITY
ALLEN-BRADLEY CO.
MILWAUKEE
WISCONSIN
CONTACTS NEED REPLACEMENT ONLY WHEN THE SILVER ALLOY HAS BEEN WORN AWAY

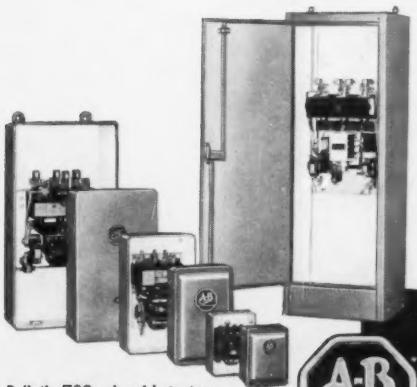
Left—Allen-Bradley Size 7 solenoid contactor used in large solenoid starters.

Below—Allen-Bradley Size 7 solenoid starter with overload relays in NEMA Type 1 general purpose, floor mounted enclosure.



ALLEN-BRADLEY SOLENOID STARTERS USE DOUBLE BREAK, SILVER ALLOY CONTACTS THROUGHOUT!

Eight Sizes up to 300 hp, 220 v; 600 hp, 440-550 v.



Bulletin 709 solenoid starters shown here in Sizes 0 to 6—all equipped with accurate and reliable overload relays.

All starter manufacturers use the solenoid construction and double break, silver alloy contacts for their lower starter ratings, because experience has proved this construction superior to any other. Therefore, wouldn't this experience repeat itself with the higher rated starters?

Allen-Bradley has found this to be absolutely true. Its starters of high hp rating are regularly establishing new standards of starter performance. As you go from size to size, the operating characteristics remain the same—you get trouble-free, long-life performance.

Standardize on Bulletin 709 solenoid starters—they are Tops in Quality!

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

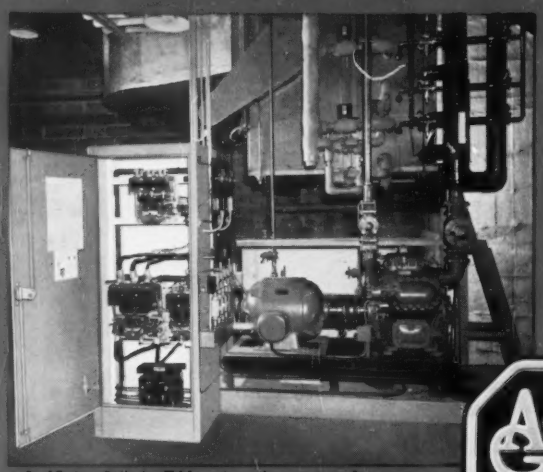
3-56-MR

A-B Quality

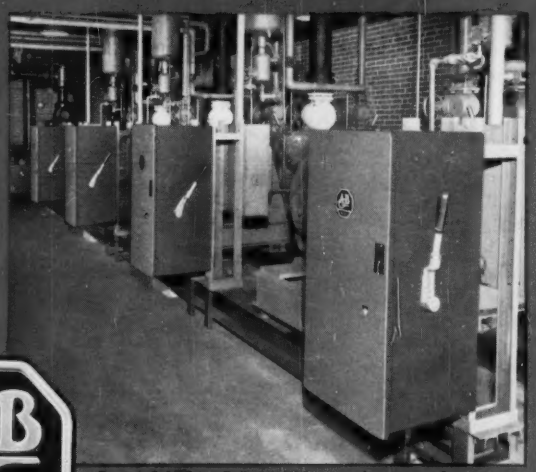
ALLEN-BRADLEY

SOLENOID STARTERS

QUALITY

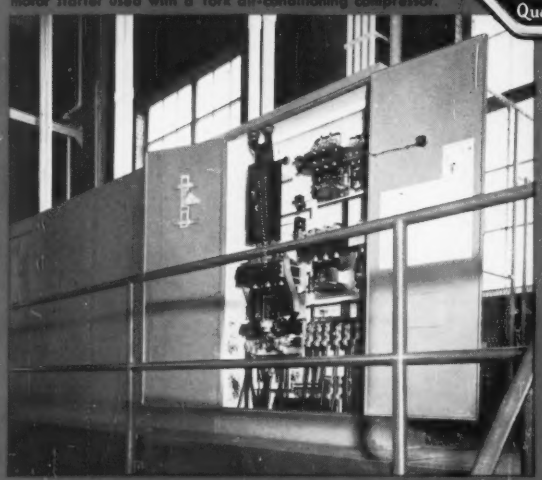


A-B 60 hp Bulletin 746 automatic autotransformer-type motor starter used with a York air-conditioning compressor.



Four A-B 125 hp Bulletin 646 manual autotransformer-type motor starters used with refrigeration compressors in a dairy.

A-B Quality



A row of A-B 350 hp Bulletin 761 automatic slip-ring motor starters with circuit breaker disconnects in the Milwaukee sewage disposal plant.

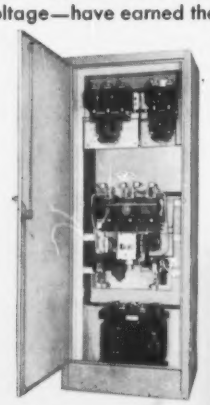
Allen-Bradley Bulletin 798 multi-unit control center used with motors ranging from 10 to 75 hp installed in a southern aircraft frost plant.

ALLEN-BRADLEY STARTERS FOR LARGE A-C MOTORS ARE AS POPULAR AS THE BULLETIN 709 SIZE 1 FOR SMALL MOTORS

Allen-Bradley manual and automatic starters for large squirrel-cage, slip-ring, and synchronous motors—both high and low voltage—have earned the same reputation for "Quality" for which the lower ratings are known. Every operating requirement can be satisfied, either with individual units or as sections of a multi-unit control center.

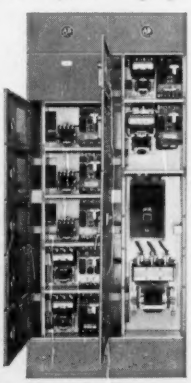
Allen-Bradley high voltage starters are rated up to 1500 hp with voltages ranging from 2000 to 4600 volts. The high voltage, synchronous motor starters are self-protecting against short circuits up to 250,000 kva on 2501-4600 volts, 3 phase, 60 cycles. Oil or air break switching available. Please write for the Handy Catalog.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.



A-B automatic autotransformer, reduced voltage starter with cabinet open to show control panel.

ALLEN-BRADLEY
SOLENOID STARTERS
QUALITY



A-B multi-unit control center with compartment doors open to show various types of motor controls.

3-56-MR

VERSATILE

MILL-M-MATIC for Accurate, Heavy Duty Production Milling . . . .

. . . for EFFICIENCY

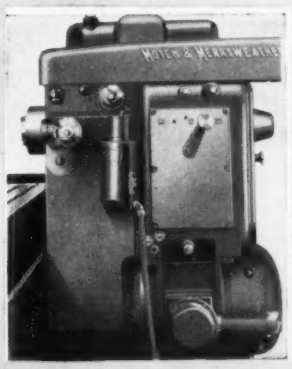
All machine functions within easy reach. All-electric, automatic controls built to conform with J. I. C. standards.

. . . for POWER

25 Hp. Anti-Friction Spindle Drive

Heavy duty milling head driven by large bull gear through involute spline. Extra wide bearing surface in housing when quill is fully extended.

. . . for QUICK, QUIET OPERATION



Hardened, ground gearing. Helical change gears for quick speed selections. Automatic spindle stop. 2-way automatic table cycles.

All the features of Mill-M-Matic point up to high, accurate production.

A fresh approach employing control by electric-mechanical powered action opens new possibilities in long life and precision operation in the field of *production milling*. Our 10-page bulletin describes all the advantages found in Mill-M-Matic.

The MOTCH & MERRYWEATHER Machinery Co.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Expensive parts machined to close tolerances are always in danger of being scratched by jagged chips hiding in the weave of ordinary wiping material. Parts so damaged have to be reworked . . . sometimes scrapped entirely.

This wiping job could cost $50

They're easy to distribute . . .

They really soak up oil . . .

Always a clean one handy . . .

Just toss 'em in the trash . . .

When you use Scott Wipers, chips don't come back to scar men and metal . . . there's always a clean new wiper handy. You use one thoroughly and throw it away. No more expensive collection, sorting, laundering and distribution.

. . . this one cost less than ½¢

The Difference is . . . Scott Wipers

Strong, highly absorbent Scott Wipers can be used and reused. Yet they cost so little you can throw them away after a single use when the job calls for a clean wiper, free of chips and abrasive material.

Scott Wipers are reducing the cost of wiping in many companies. Sorting and baling are eliminated. Handling and distribution are simplified. Laundering becomes a thing of the past.

This is sanitary wiping. A man uses a Scott Wiper thoroughly, throws it away—takes a new one. No danger of cuts from hidden chips . . . no fear of skin infection from dirty wipers.

Put the Scott Wiper through its paces on your production line. Your local Scott representative or distributor is ready to demonstrate any time you say. Call today or mail this coupon.

SCOTT PAPER COMPANY
Dept. W-1, Chester, Pa.
Please send me more information about Scott Wipers.

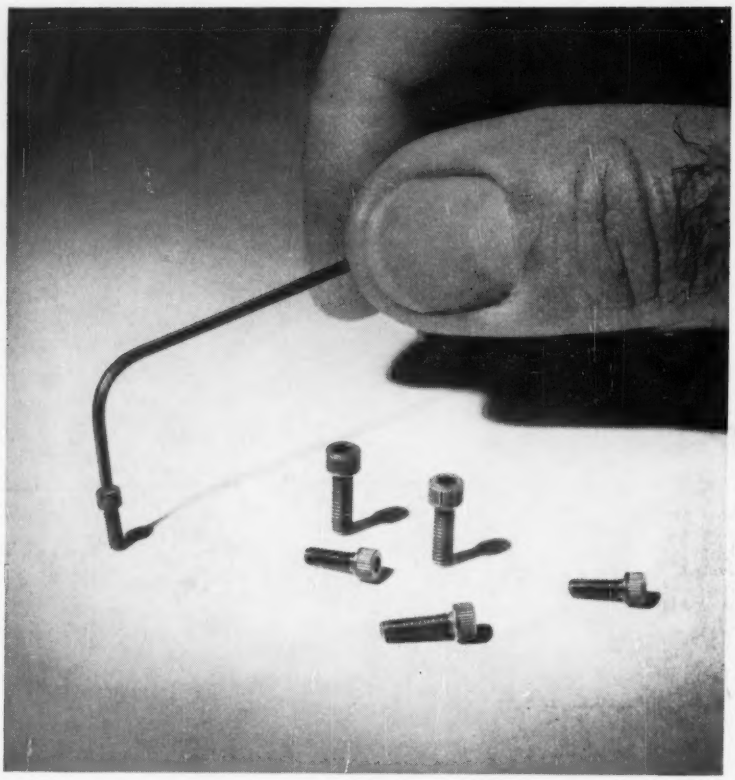
Name_____

Company_____

Position_____

Address_____

Miniature screws aid standardization of small devices



Standard UNBRAKO miniature socket head cap screws are available in sizes # 0, # 1, # 2 and # 3, in heat treated alloy steel or stainless steel, at your authorized industrial distributor's. Standard lengths range from ⅛ to ½ in.

Tiny close-tolerance Unbrako screws available in standard sizes

New economies in the design of space-saving miniature equipment are possible with these UNBRAKO miniature socket head cap screws. Manufactured to timepiece precision, available locally, they save the costly necessity of designing special screws to fasten tiny parts in compact units. They're ideal for use in typewriters, calculators and computers, servomechanisms, electric and electronic equipment—and in countless other small, intricate devices where maximum reduction in bulk and weight is required with no sacrifice in strength of individual components or assemblies.

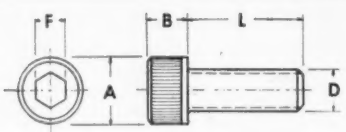
Fingers grip the knurled heads on these tiny screws positively for easy handling and fast assembly. Uniform hex sockets assure maximum wrenching torque. Controlled fillets under the heads prevent shearing of the heads. Threads are fully formed for maximum strength and exact fit. Extremely accurate head diameters permit their use in countersunk holes, saving weight by reducing the length of the screw required and making flush designs possible.

These standard UNBRAKO miniature screws are available at your authorized industrial distributor's. See him today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

See us at Booth 479—ASTE Show

HEAT-TREATED ALLOY STEEL

Class 3 Fit Standard



	Diameter	Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0	A .104		80	⅛		2.0	.152
	B .060		80	3/16		2.0	.182
	D .060		80	¼		2.0	.210
	F .050		80	⅜		2.0	.265
#1	A .118		72	⅛	3.5	3.5	.27
	B .073		72	3/16	3.5	3.5	.32
	D .073		72	¼	3.5	3.5	.37
	F .050		72	⅜	3.5	3.5	.47
#2	A .140	56		3/16	6.0	6.0	.42
	B .086	56		¼	6.0	6.0	.50
	D .086	56		⅜	6.0	6.0	.58
	F 1/16	56		½	6.0	6.0	.70
#3	A .161	48		3/16	8.5	9.5	.59
	B .099	48		¼	8.5	9.5	.70
	D .099	48		⅜	8.5	9.5	.81
	F 5/64	48		½	8.5	9.5	1.03

Standard Screws are threaded to the head. Special materials, lengths, and threaded lengths are available. One "High-Titan" UNBRAKO hex key is included with each package of 100 screws.

UNBRAKO®

SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

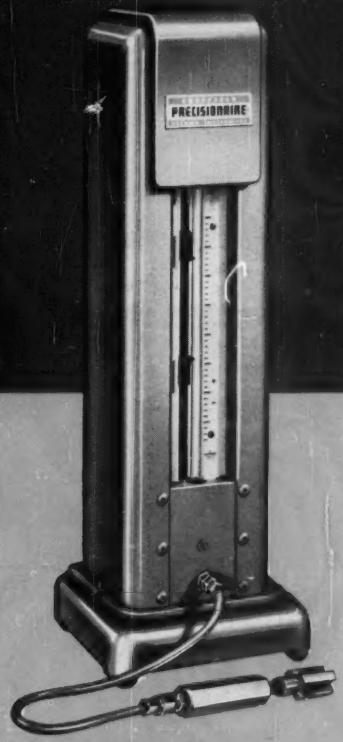
JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 255

FREE DEMONSTRATION

SHEFFIELD Adjustable AIR GAGES

for Short Runs and Emergencies



SUCH AS:

- Aircraft manufacturers, subcontractors and job shops having limited production.
- Accidental damage to a vitally needed single purpose gage.
- An unexpected engineering change involving part size.
- A short run of special parts for which no gages have been provided.
- A mistake or failure in ordering the needed single purpose gages.
- Sudden need for process gages at the production machines.

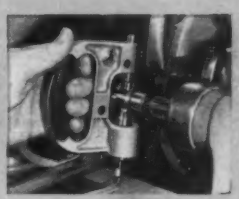
Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the adjustable air gages here illustrated is your best insurance against unpredictable production losses. ***The Sheffield Corporation, Div. #600, Dayton 1, Ohio, U.S.A.***

ADJUSTABLE BALLJET SPINDLE KITS
1" to 3"

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3". No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.

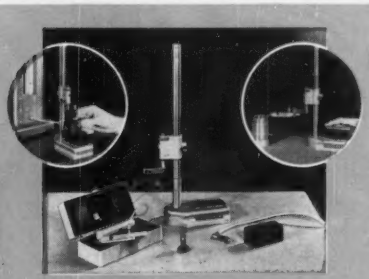
ADJUSTABLE AIREBORE GAGE KITS
3" to 12"

The Airebore Gage can be set precisely to any diameter from 3" to 12" by means of a calibrator and gage blocks. No master rings are needed.



PLUNJET ADJUSTABLE SNAP GAGES
0" to 12"

Twelve Plunjet Adjustable Snap Gages cover a gaging range from 0" to 12"—Larger sizes on special order.

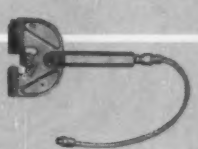


AIRETEST AND PLUNJET STAND

This stand accommodates an Airetest Indicator—also converts to a comparator or height gage by using a Plunjet or dial indicator and anvil.

SELF-CENTERING ADJUSTABLE SPINDLES
$\frac{1}{32}$" to 3"

Four Self-centering Adjustable Spindles cover respectively the ranges of $\frac{9}{32}$" to $\frac{7}{16}$", $\frac{7}{16}$" to $\frac{7}{8}$", $\frac{7}{8}$" to $1\frac{1}{2}$" and $1\frac{1}{2}$" to 3". All but the smallest can be set with gage blocks.



STANDARD ADJUSTABLE AIRSNAPS
$\frac{1}{4}$" to $5\frac{1}{2}$"

Available in 17 models to cover the range .2500" to 5.500". Up to 3.000" the anvil has an adjustment of $\frac{1}{4}$"—above that, $\frac{1}{2}$".

MASTER CRAFTSMAN GOLDEN ANNIVERSARY HEADQUARTERS

SHEFFIELD

manufacture and measurement for mankind

Call Your Sheffield Representative for a Demonstration in Your Plant

This is a fast

Every hour, this Newton Vertical Rotary roughs and finish mills the tops of 600 aluminum pistons at 85% efficiency.

The machine automatically clamps, unclamps and ejects the finished pistons onto a conveyor. All the operator does is load!

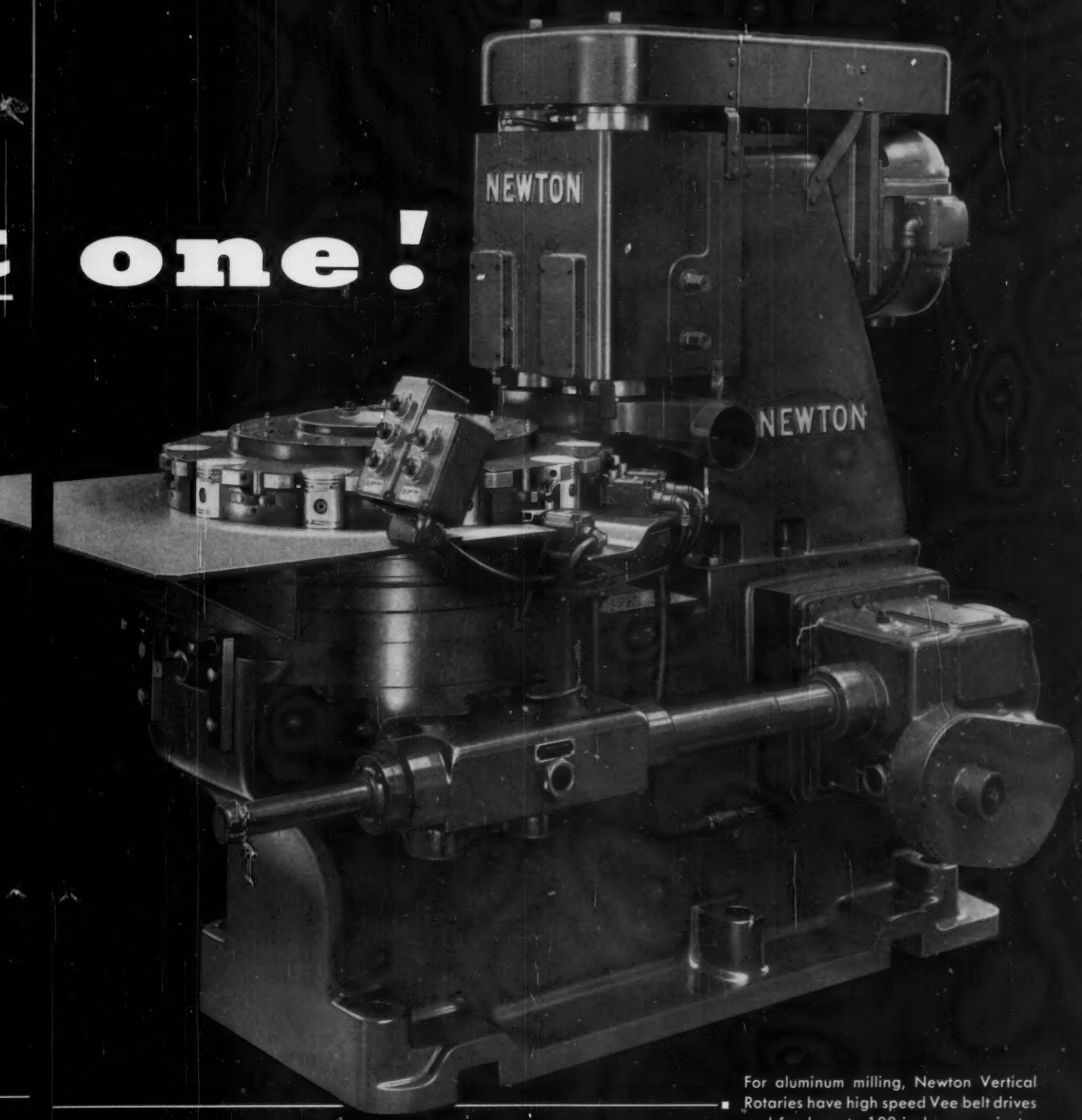
A Newton Vertical Rotary is more than a machine tool—it is a method—the fastest known method of milling the flat surfaces of repetitive pieces!

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED MACHINE TOOL

A DIVISION OF FARREL-

one!



For aluminum milling, Newton Vertical Rotaries have high speed Vee belt drives and feeds up to 100 inches per minute.

COMPANY, ROCHESTER 10, N. Y.

FB

BIRMINGHAM CO., INC.

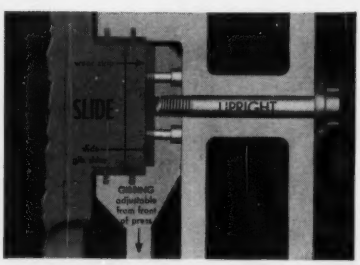
if you manufacture parts *like these...*

A BLISS HIGH PRODUCTION PRESS may triple your output...or more

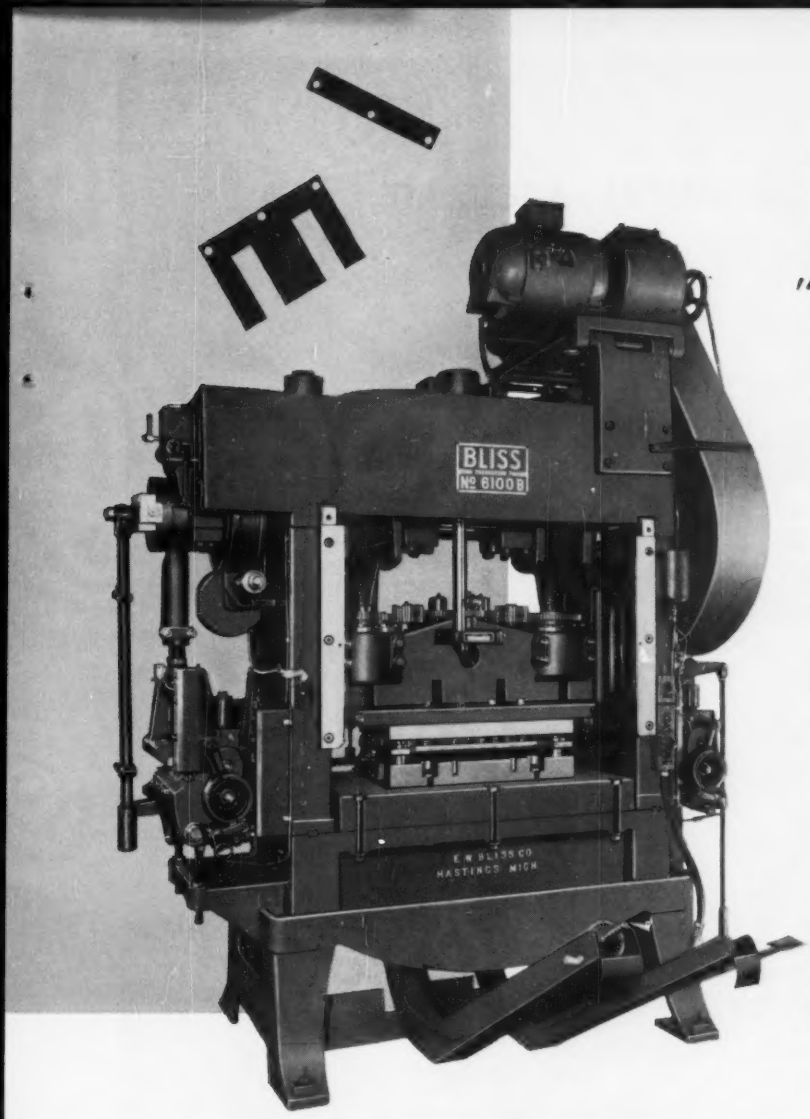
EXCLUSIVE DESIGN FEATURES...assure accuracy at high speed

RUGGED FRAME: The dense, cast Meehanite frame *absorbs sound*, eliminates ringing "ping" at high speeds. Heavy four-piece frame members are keyed and joined by steel tie rods which are "pre-shrunk" to a tension greatly exceeding press capacity. Extra heavy sectioned bed and crown holds deflection to a maximum of 0.001" per foot at press capacity under normal loading conditions. Heavy reinforced crown gives extra support to the shaft. The design of the frame leaves plenty of room for die set up—provides chute space *under* the press.

VARIABLE SPEED DRIVES are standard on H-P presses so that each job can be run at its most efficient speed.



SQUARE GIBS provide precision fit—no more than a 0.0015" feeler goes between gib and slide, although slide moves freely. Location of gibs close to centerline resists tendency of slide to tilt under off-center loads—slide is held parallel to bed within 0.0005" per foot on all dimensions.



Long runs not essential, users report

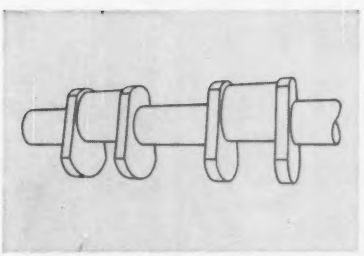
"we set up in 15 minutes, run 3000 parts in another 10..." is typical experience

Consider this: a Bliss H-P Press is usually able to replace from 3 to 12 older and slower presses. And the savings in space, tooling and handling costs alone are often enough to write off the cost of a H-P press.

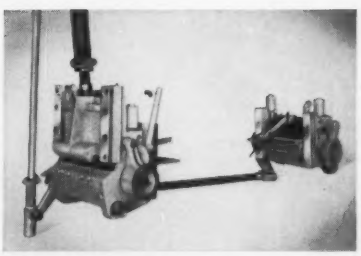
But the really important saving is in the cost of the parts themselves, because you get so many more so much faster and dies last so much longer.

Fast set-up makes that true for both long and short run work. IBM, for example, needs only *eleven* H-P presses to turn out multi-thousand quantities of more than 1500 different parts every three months. Their average set-up time: 48 minutes.

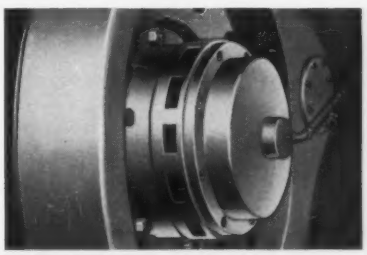
H-P presses are available from 12 to 300 tons, non geared or single geared. Special designs, special feeds extend their use to practically all stamping requirements. We'll be glad to send you complete information by return mail.



COUNTERBALANCED to eliminate vibration. Slide and tools are counterbalanced by means of air cylinder in crown. Where top speed of press requires, the crankshaft is dynamically balanced and the throwblock for the feed is balanced by a compensating weight on the feed adjusting screw.



BLISS FEEDS: Bliss makes its *own* single roll, double roll and special feeds to assure accurate feeding at high speeds. Typical of Bliss design is its roll feed clutch—with *eight* or more rollers bearing on *Stellite* inserts in the hub, it gives greater accuracy *longer*.



AIR FRICTION BRAKE AND CLUTCH: Special design gives die setter and operator complete and accurate control of the press. Air pressure can be set so clutch will slip under severe overloads. In addition, this cool-running clutch automatically adjusts itself for wear.

BLISS
SINCE 1857

is more than a name...it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

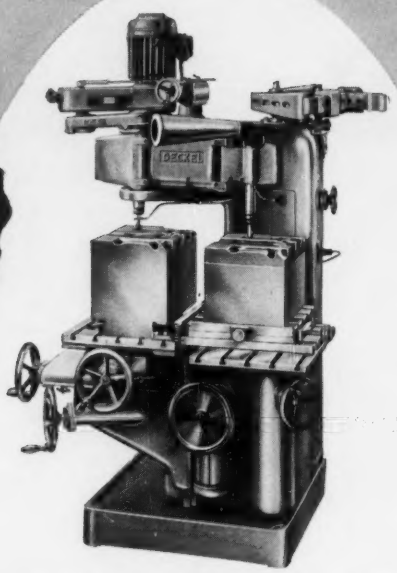
U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pennsylvania. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Pittsburgh, Rochester, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

ECONOMICAL, ACCURATE PRODUCTION OF DIES AND MOLDS WITH THE LATEST

DECKEL

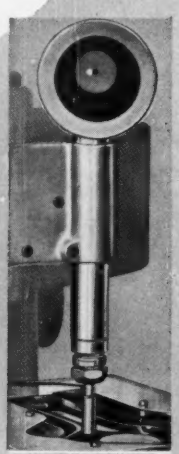
universal pantograph DIE SINKING MACHINE model KF12

Deckel die sinking machines are justly famous for their accuracy, production rate, and ease of operation. The KF12, latest and largest Deckel model, does heavy die-sinking jobs which formerly required much greater investment in equipment. Spindle speeds from 60 to 10,000 r.p.m. enable you to do rough and finish milling, as well as light engraving, on the same machine. The newly developed, "mirror image" milling attachment produces right and left hand dies and molds from the same pattern. Other important features are illustrated below.



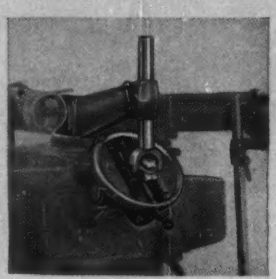
Deckel KF12 makes rapid, accurate enlargements or reductions from 1:1.5 to 1:4 as well as 1:1 duplication. The cutting tool covers an area up to 15¾" x 15¾" or up to 10" x 19¾".

Optical contacting device makes rough milling faster, more accurate. And, accurate rough milling reduces time for finishing.



Saddle elevating motor rapidly raises or lowers master and workpiece at the same time.

Circular forming attachment permits generating spherical shapes.



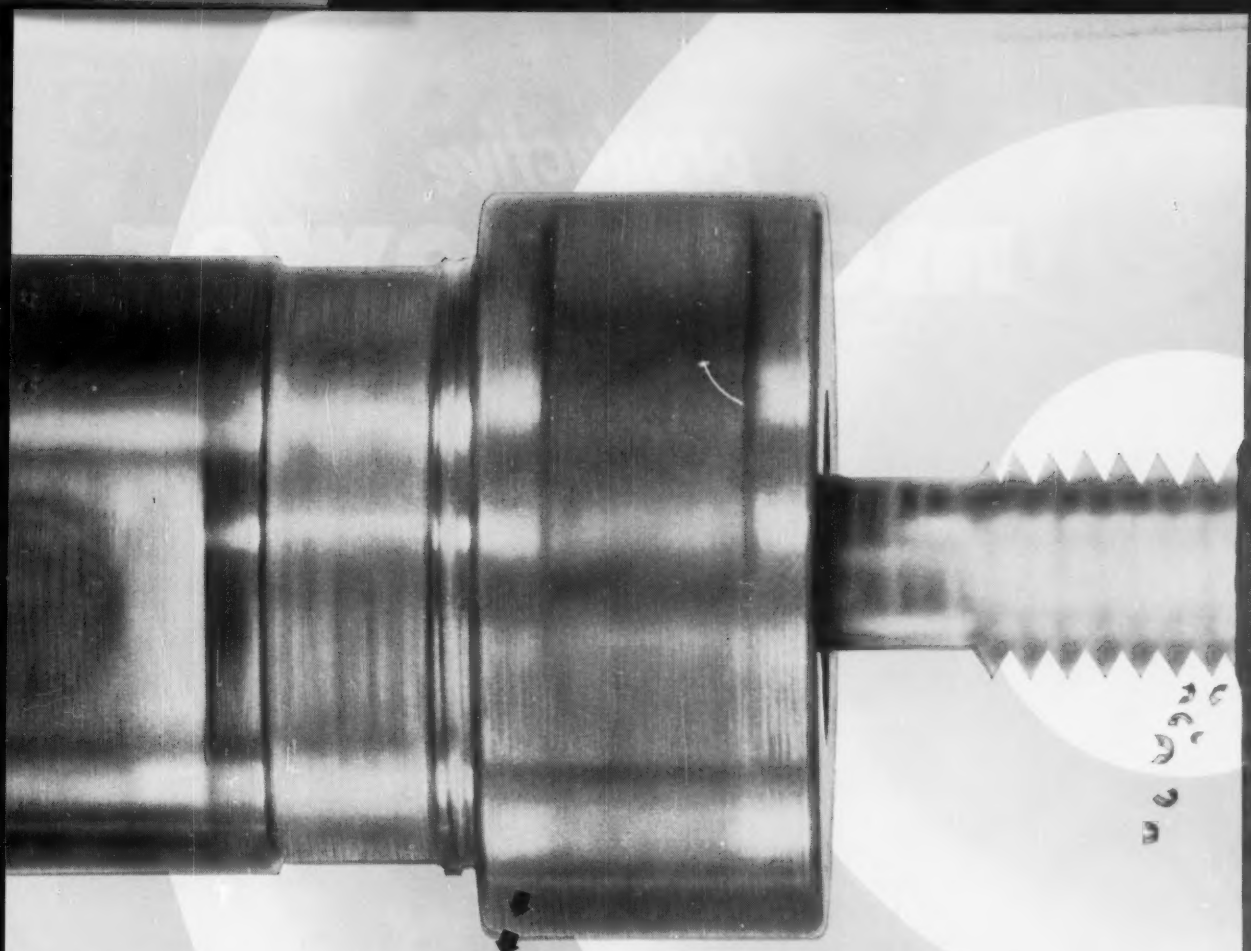
Get in touch with us soon for information on this or other Deckel machines: 2-DIMENSIONAL ENGRAVERS • 3-DIMENSIONAL ENGRAVERS; UNIVERSAL MILLERS • UNIVERSAL TOOL & CUTTER GRINDERS

COSA — *nationwide sales and service of precision machine tools — from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact COSA CORPORATION OF CANADA LTD., 40 Front Street West, Toronto

For more information fill in page number on Inquiry Card, on page 255



Tops for Taps... it's a *Jacobs* CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks... first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.

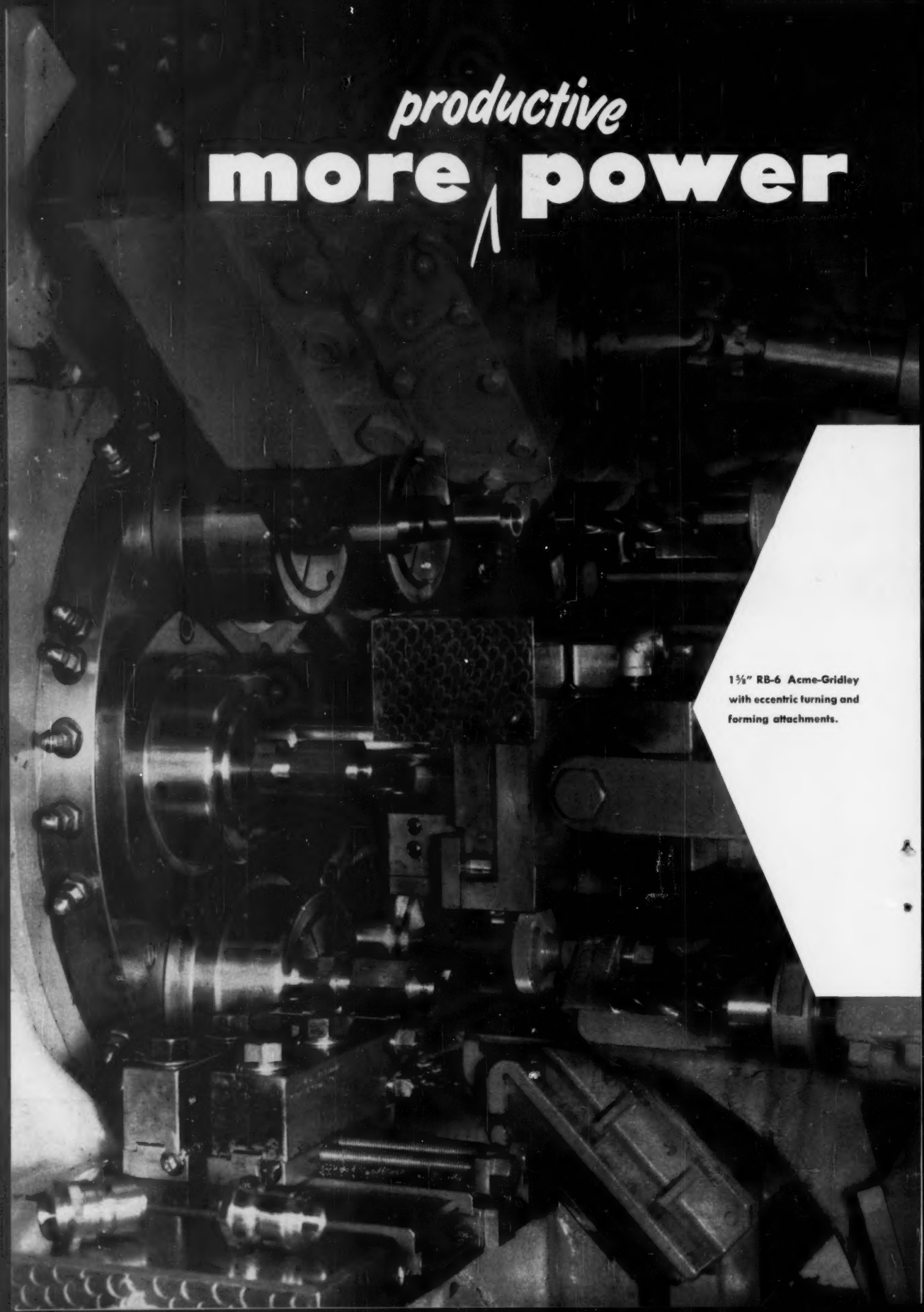
The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

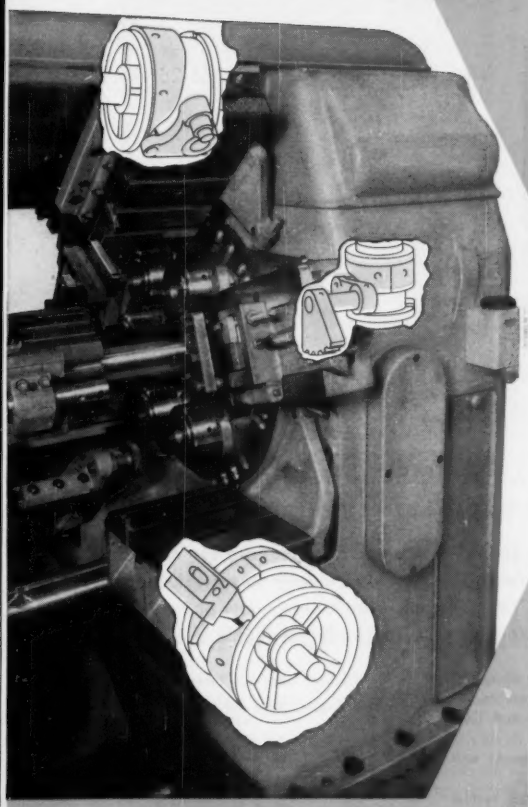
more productive power



1⅝" RB-6 Acme-Gridley with eccentric turning and forming attachments.

to you!

Acme-Gridley independently-operated direct cross-slide camming



Lets you use maximum machine horsepower for rapid metal removal—without chatter and at predetermined accuracy—throughout an entire run. Basic design of Acme-Gridleys built for heavy cuts calls for proper distribution of "beef" in the machine frame to rigidly support top, bottom and intermediate slides so that they can transmit power to the tip of the tool with no linkages.

Cross slides operating from their own cam drums not only improve overall machine efficiency, but extend the range of applications for which the machine can be tooled. And when, as in the case of Acme-Gridleys, ample frame strength is combined with short coupled power transmission to the tool, you've got a combination that pays off in two ways—improved performance and reduced maintenance.

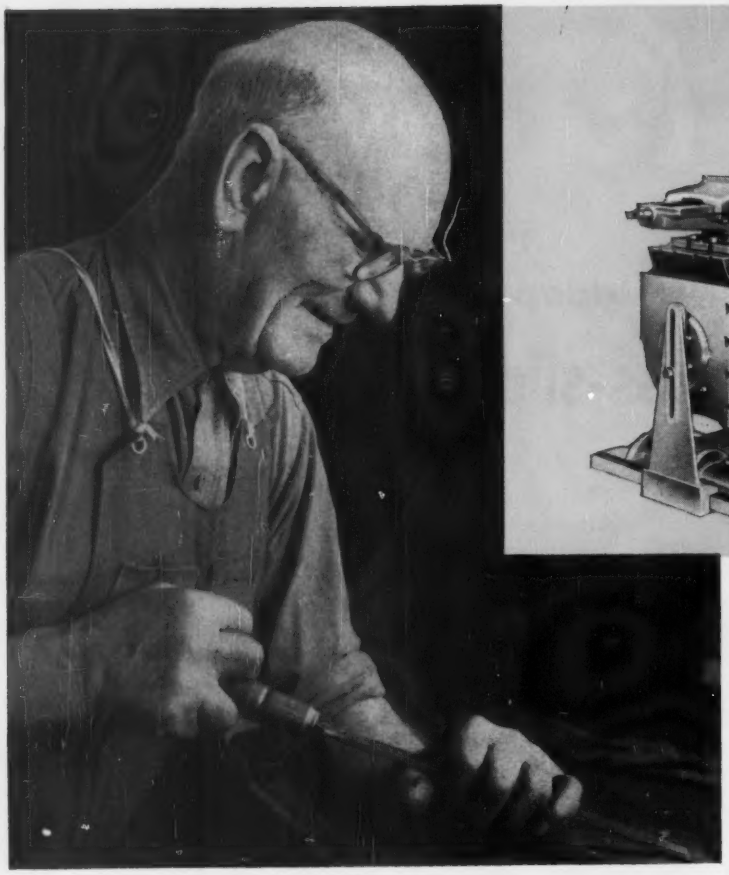
LET US TELL YOU MORE ABOUT
***Acme-Gridley* BASIC DESIGN**

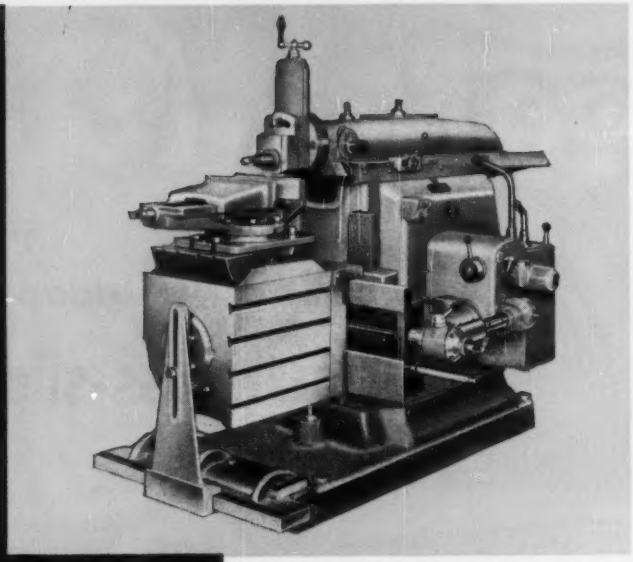
Independently-operated, direct camming is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark, N. J. • Chicago, Ill. • Detroit, Mich.





VMA Universal Shaper Model ES-26

UTOMORDENTLIG YRKESSKICKLIGHET

(SUPERB CRAFTSMANSHIP)

VMA SHAPERS - built by Sweden's master craftsmen - are engineered to maintain precise tolerances in continuous heavy-duty production. Built to U. S. standards, VMA Shapers—both heavy duty and standard models — meet all requirements for modern versatile machines.

VMA Model ES Heavy Duty Shapers, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
- Double helical crank gear
- Chrome nickel steel transmission
- Anti-friction bearings throughout
- Dependable safety clutch

VMA Model EV Series . . . economical standard-duty Shapers with stroke lengths from 14" to 24".

- Highly accurate and dependable, Model EV Shapers are ideal for job shop or tool room use not requiring the extra power of the ES Series. Easy to operate — economical to own.

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INDUSTRIAL CORPORATION

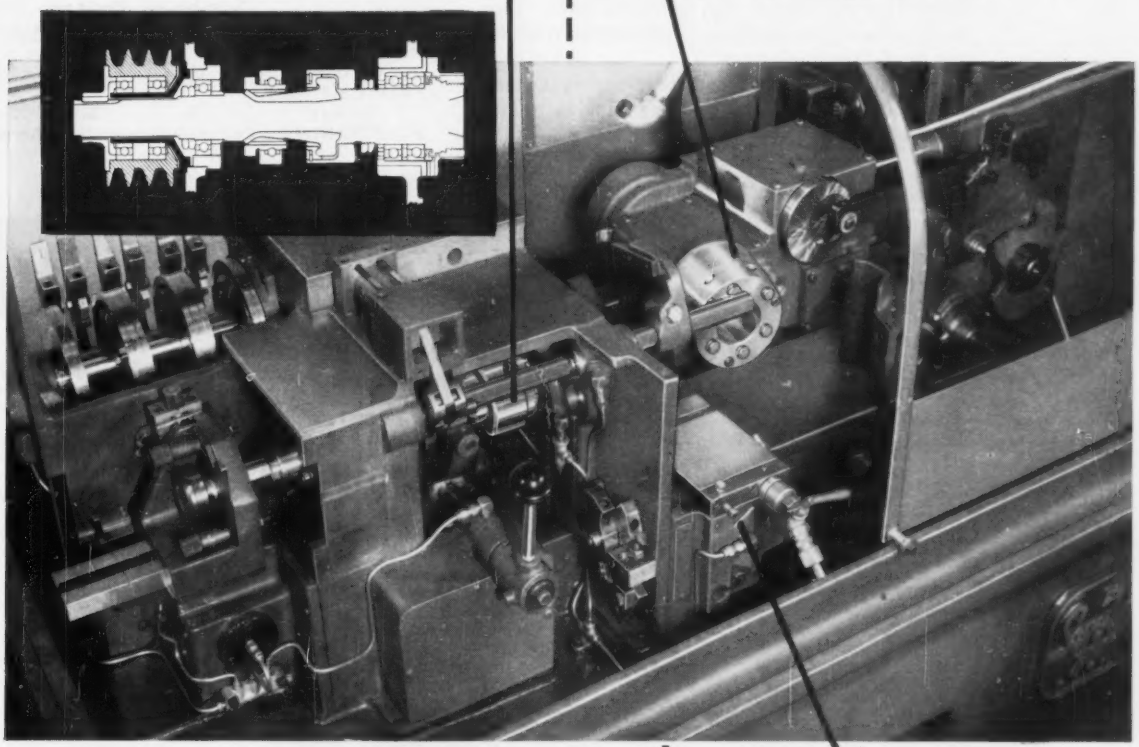
76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

1 EXTRA-RUGGED SPINDLE

The extra-rugged spindle, with preloaded angular contact double row ball bearings at the nose, is designed to withstand high tool pressure with no end or side play. Clutch and transmission load has been eliminated. The sheave bearing is mounted directly to the housing.

2 ANGULAR POSITION OF TURRET

Turret moves freely on replaceable ways of heavy, rigid construction. A 10° offset of the turret causes accurate seating during heavy cutting. Angular position allows greater clearance for larger end working tools, thereby attaining greater accuracy.



3 "precision" reasons why the Detroit Screwmatic 750 out-performs competition in production runs

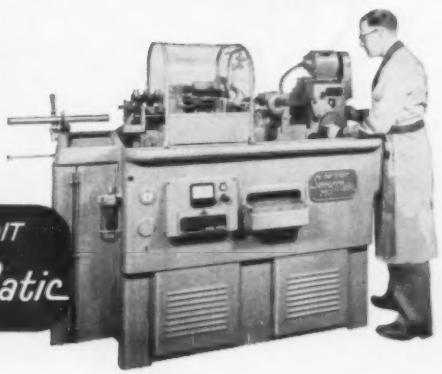
In actual tests with three leading screw machines, the Detroit Screwmatic 750 has manufactured complicated pieces 300% faster while holding tolerances as close as ± .0003".

This unusual performance is typical of what you can expect from the truly advanced design features of the Detroit Screwmatic 750. Illustrated here are just three of the "precision" factors which make it possible.

You'll want to know more about the revolutionary Detroit Screwmatic 750 and how it can increase the efficiency of your screw machine operations. Write today for complete information. It will be sent to you immediately.

3 HEAVY DUTY CROSS-SLIDE DOVETAILS

A side mounted arrangement of the cross-slide creates a seating action of the dovetail. This seating action increases with the cutting pressure, consequently reducing or eliminating the possibility of chatter. Heavy forming on all slides is possible because of this heavy duty dovetailed construction which offers utmost forming precision.



A Product of

THE GEAR GRINDING MACHINE CO.

3921 Christopher • Detroit 11, Michigan

Manufacturers of: Fully Automatic Gear Grinding Machines • Rzeppa (pronounced "Shappa") Constant Velocity Universal Joints

For more information fill in page number on Inquiry Card, on page 255

"Operations Kingsbury" includes straddle milling two

Front and rear hangers for an automobile front spring assembly are machined on these two Kingsburys. Design of each part requires work from three directions: top, front *and back*. This work is accomplished in one cycle without rotating the work-holding fixtures.

These two machines illustrate several important advantages, appreciated by design engineers and production men.

For example: high production at low cost per part. The following table tells this story:

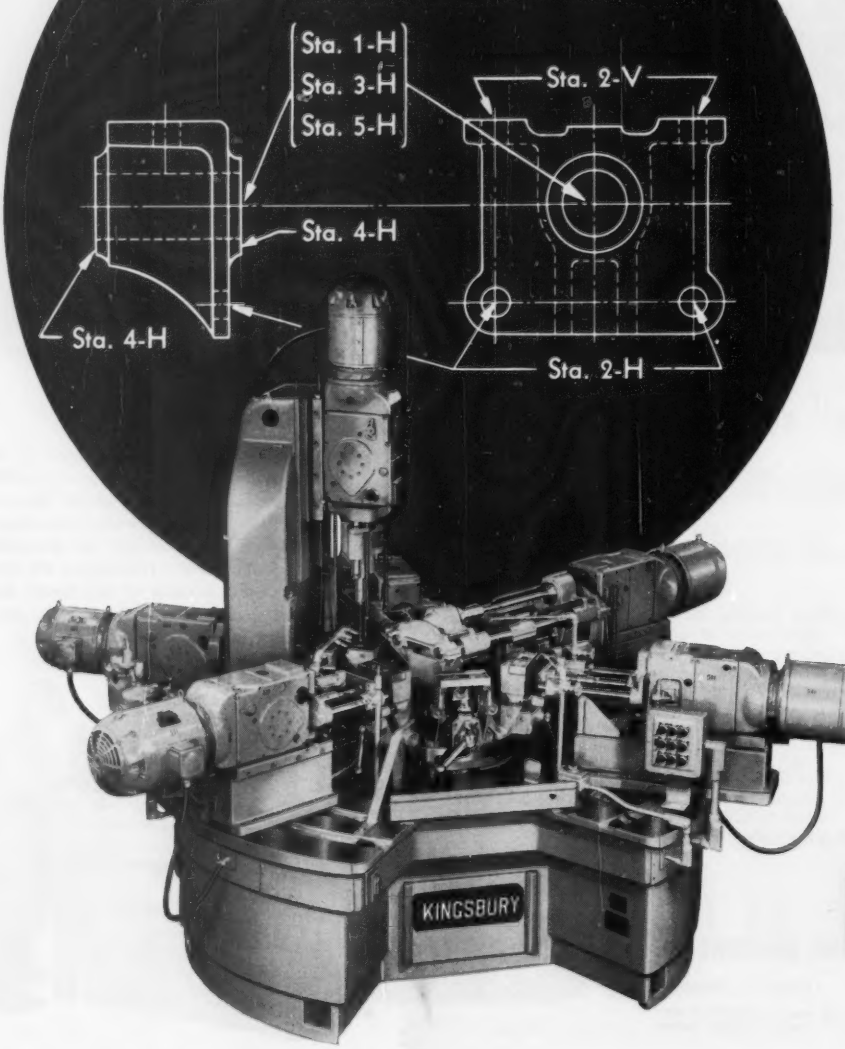
Part	Number of Operations	Parts per hour, gross	Cost per part
REAR HANGER (at right)	10	240	4-6/10c .
FRONT HANGER (at left)	9	265	3-6/10c

REAR HANGER: Two milling operations for only 1c.

9 Operations - 3 6/10 ¢ per part

(Malleable Iron)

FRONT SPRING FRONT HANGER



This Kingsbury machine has a 96-inch base and 26-inch index table. Six work units are mounted on the base. Six work-holding fixtures are mounted on the table, which indexes through six-stations (one for loading and unloading). All work is performed at five stations, without removing the part from the fixture.

Work	Operations
Station 1-H: Core drill .853/.855 hole undersize	1
Station 2-H: Drill .375 thru — two holes	2
Station 2-V: Drill .375 thru — two holes	2
Station 3-H: Rough ream .853/.855 hole undersize	1
Station 4-H: Spotface bosses 1.25 dia., front and rear	2
Station 5-H: Finish ream .853/.855 hole thru to size	1
Total Operations	9

KINGSBURY

bosses for approximately one cent

There's nothing particularly difficult about any of these operations — until we consider the production output and low cost per part. Even at 80% efficiency, delivery of a finished part such as these *every* 19 *seconds* or less, is profitable business for the manufacturer.

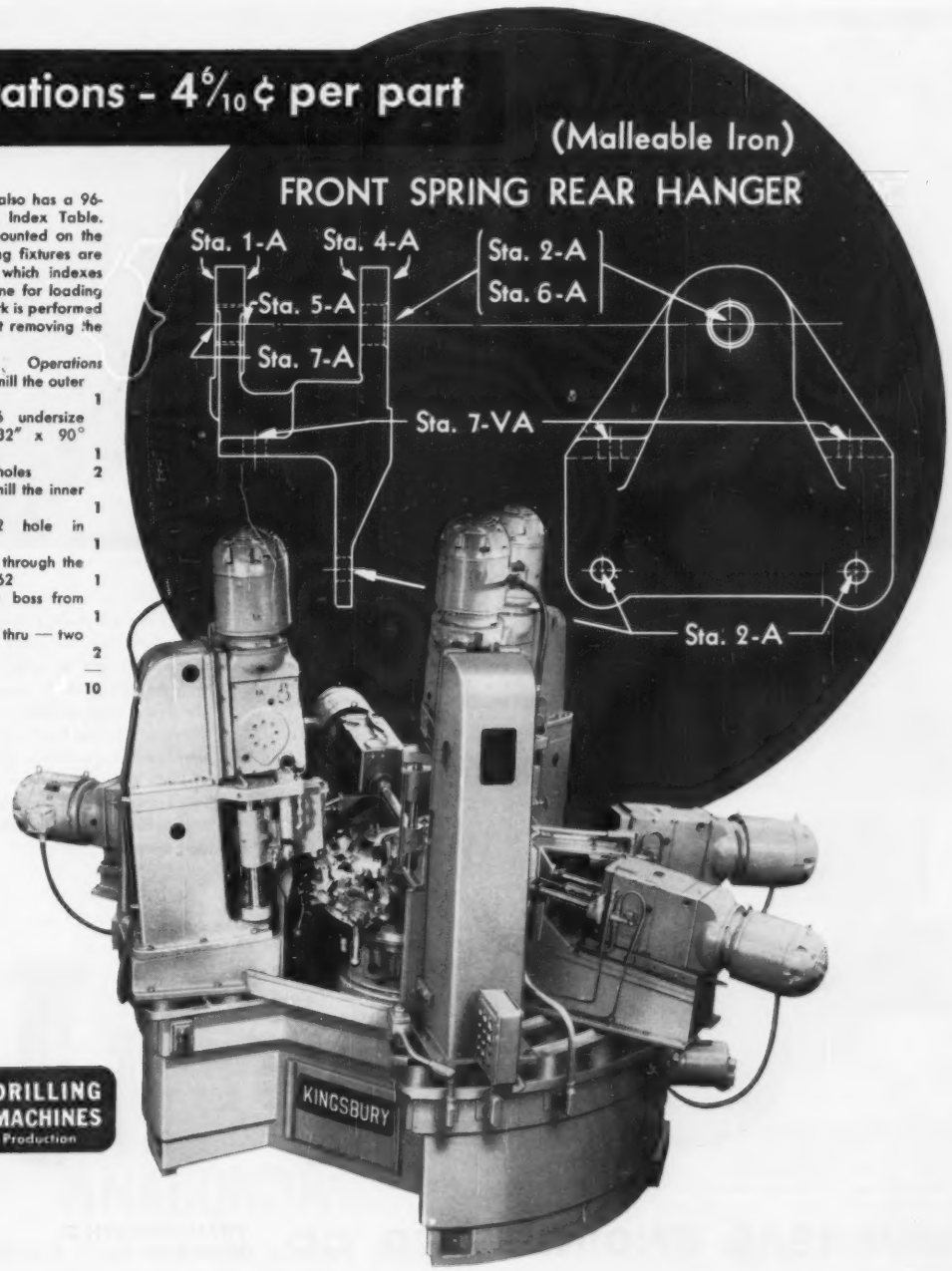
Today, the design engineer has greater freedom than ever before. He can now design parts with less worry about *manufacturing* operations . . . because, here at Kingsbury we know what operations a Kingsbury *can* do. So, if we feel that a Kingsbury machine will justify itself in your production schedule, you can plan on high production, low cost per part, and uniform quality.

Kingsbury Machine Tool Corporation
111 Laurel Street
Keene, New Hampshire

10 Operations - 4 6/10 ¢ per part

(Malleable Iron)

FRONT SPRING REAR HANGER



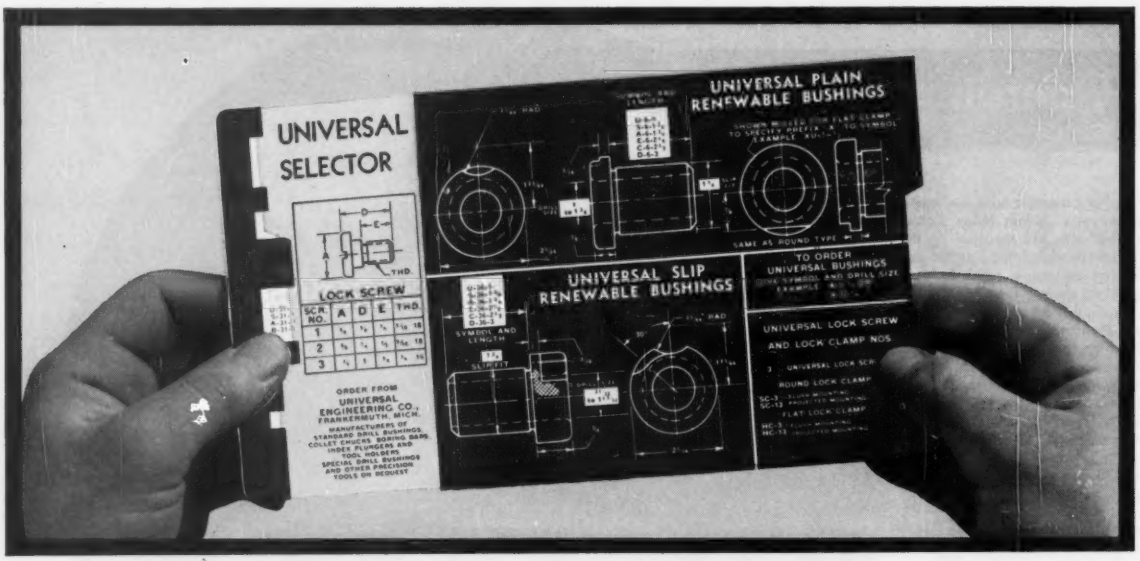
The Kingsbury machine also has a 96-inch base, with 30-inch Index Table. Seven work units are mounted on the base. Eight work-holding fixtures are mounted on the table, which indexes through eight stations (one for loading and unloading). All work is performed at seven stations, without removing the part from the fixture.

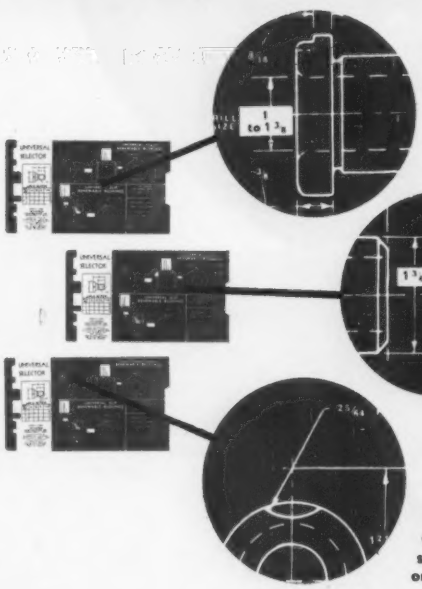
Work	Operations
Station 1-A: Straddle-mill the outer boss	1
Station 2-A: Drill .656 undersize and countersink 23/32" x 90° one hole in outer boss	1
Drill .375 thru — two holes	2
Station 4-A: Straddle-mill the inner boss	1
Station 5-A: Drill .562 hole in inner boss	1
Station 6-A: Line ream through the two holes, .656 and .562	1
Station 7-A: Tap inner boss from rear: ⅝ — 16 Tap	1
Station 7-VA: Drill .375 thru — two holes	2
Total Operations	10

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

HOW THE UNIVERSAL DRILL BUSHING SLIDE CHART SIMPLIFIES JIG DESIGN

new plastic, pocket-size calculator gives all engineering data for the selection of all types and sizes of drill jig bushings up to 1¾″ drill size


UNIVERSAL SELECTOR
LOCK SCREW
SCR. NO. A D E THD.
ORDER FROM UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICH.
UNIVERSAL PLAIN RENEWABLE BUSHINGS
UNIVERSAL SLIP RENEWABLE BUSHINGS
TO ORDER UNIVERSAL BUSHINGS
UNIVERSAL LOCK SCREW AND LOCK CLAMP NOS



The SELECTOR is divided into four areas, one for each of the four types of bushings. The example shown here is for the plain renewable. Using this area, you move the slide until the correct drill size appears in the drill-size window.

Once the drill size is set up on the SELECTOR, all other factors now appear in the windows. This section, for example (shown actual size) shows correct bushing O.D. and dimension from center to flat for clamp.

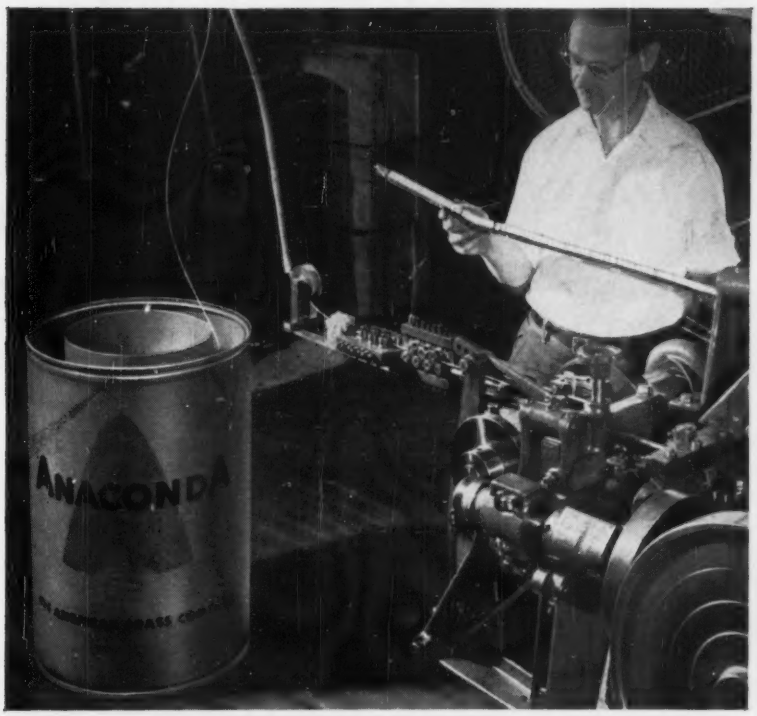
This section shows the radius for lock screw. Every factor you need for drill bushing jig design as well as for ordering the correct bushing to fit that design is shown correctly, exactly, and at a glance on the SELECTOR.

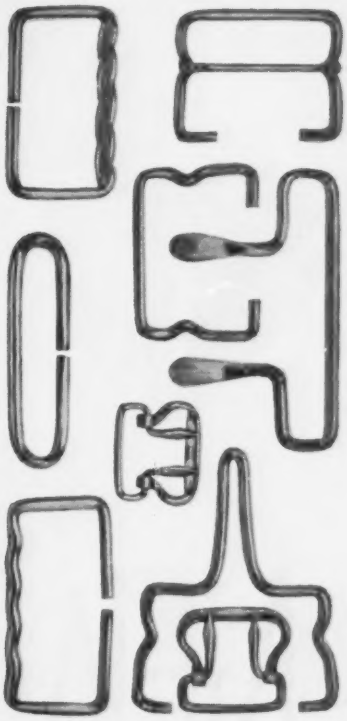
A new service to regular users of drill jig bushings is this extremely practical plastic Selector slide-chart. When designing jigs, you will save many hours, and be certain of your accuracy, with the SELECTOR. It represents the result of six years experimentation and research by Universal Engineering Co. If you are an engineer specifying bushings and do not have one of these slide calculators—you can have one for your own design work by simply requesting it on your company letterhead. Don't wait—do it today!

193

UNIVERSAL ENGINEERING CO. FRANKENMUTH 2, MICHIGAN

Anaconda Wire now available in New Pay-off Container





BUCKLES AND BUCKLE PARTS made by West Haven Buckle Co., West Haven, Conn., using Anaconda 70-30 yellow brass wire. Finished buckles, later nickel plated, are of highest quality, noncorroding, for use in surgical bandages, trusses, corsets and other surgical appliances.

Shutdowns to change coils in wire forming machines cut 90% at West Haven Buckle Company

The West Haven Buckle Company of West Haven, Conn., used to be limited to relatively light coils of brass wire because of the slide feed necessary for free pay-off into its wire forming machines. Machines could operate less than an hour before shutdown to feed in another coil.

When they started using Anaconda Wire packaged in the *new pay-off barrel*, which provides free pay-off, the runs were increased 10 times. The big coils of brass wire—400 to 500 pounds—made possible continuous runs of from 8 to 9 hours. This cut the time lost in changing coils 90 per cent. It eliminated the labor of shifting and lifting heavy coils—as the wire is fed directly from the barrel.

An easy way to increase production, cut costs: Big coils of Anaconda Wire in the *new pay-off barrel* give you these advantages:

1. Reduced down-time to change coils can mean production increases up to 25 per cent. Free pay-off feature may enable you to increase machine speed for still greater production.
2. Operators are freed for other duties during the longer continuous runs.
3. Easier handling, better inventory control. Barrels are clearly marked for quick identification—are easily handled by standard hand trucks—utilize storage space efficiently—can be stacked. Losses are minimized because coils stay clean indefinitely—there is no danger of coils becoming tangled or mixed.

No extra charge for Anaconda Wire in the new pay-off container. Call your American Brass Company representative today or write: The American Brass Company, Waterbury 20, Conn. 5585

THE NEW CONTAINER which provides Anaconda Wire in 400 to 500 pound coils, ready for free pay-off into pin machines and other automatic forming machinery. Anaconda wire in all alloys is available packaged this way for long, continuous runs—in all gages up to .090", in tempers at least one number hard.

ANACONDA®

COPPER AND COPPER ALLOY WIRE

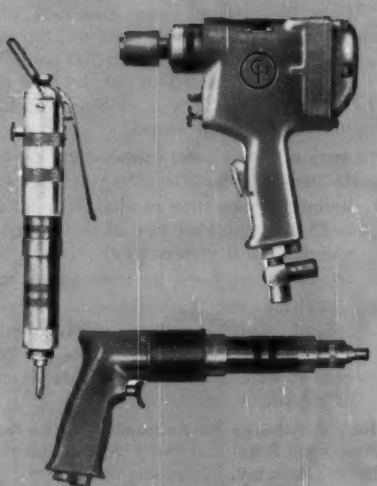
For more information fill in page number on Inquiry Card, on page 255

NEW! "Magnamatic"...

CONTROLLED TORQUE SCREWDRIVER-NUTRUNNER

with the ***One-Shot*** *Clutch*

An air-driven torque screwdriver-nutrunner that can be set to run screws and nuts to specified torque — that's the CP One-Shot "Magnamatic." The Alnico magnetic One-Shot clutch, adjustable to specified torque, disengages completely the instant the fastener is driven to desired tightness. And "Magnamatic" is quiet — the clutch does not impact or ratchet. It maintains the selected torque setting indefinitely — prolongs clutch jaw life. Inexperienced operators don't burr screw heads, strip threads, shear fasteners, or damage work. Screw bits last longer.



CAPACITIES: #4 screws to ⅜" bolts. Reversible and nonreversible types.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

ONE-SHOT "MAGNAMATIC" SCREWDRIVER-NUTRUNNER

— the quietest ever developed because clutch buzz and ratcheting have been eliminated . . . and exhaust noise is effectively muffled by a new principle of baffling.

— can be set to drive fasteners to specified torques.

— keeps the selected torque setting indefinitely

— prolongs clutch jaw life.

— disengages the instant the fastener is run to desired tightness.

— eliminates stripped threads, sheared fasteners, surface damages.

— prolongs service life of screw bits.

Chicago Pneumatic Tool Company, Dept. M-21
8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories."

☐ Please send me "Magnamatic" Bulletin SP-3126.

☐ Have representative call.

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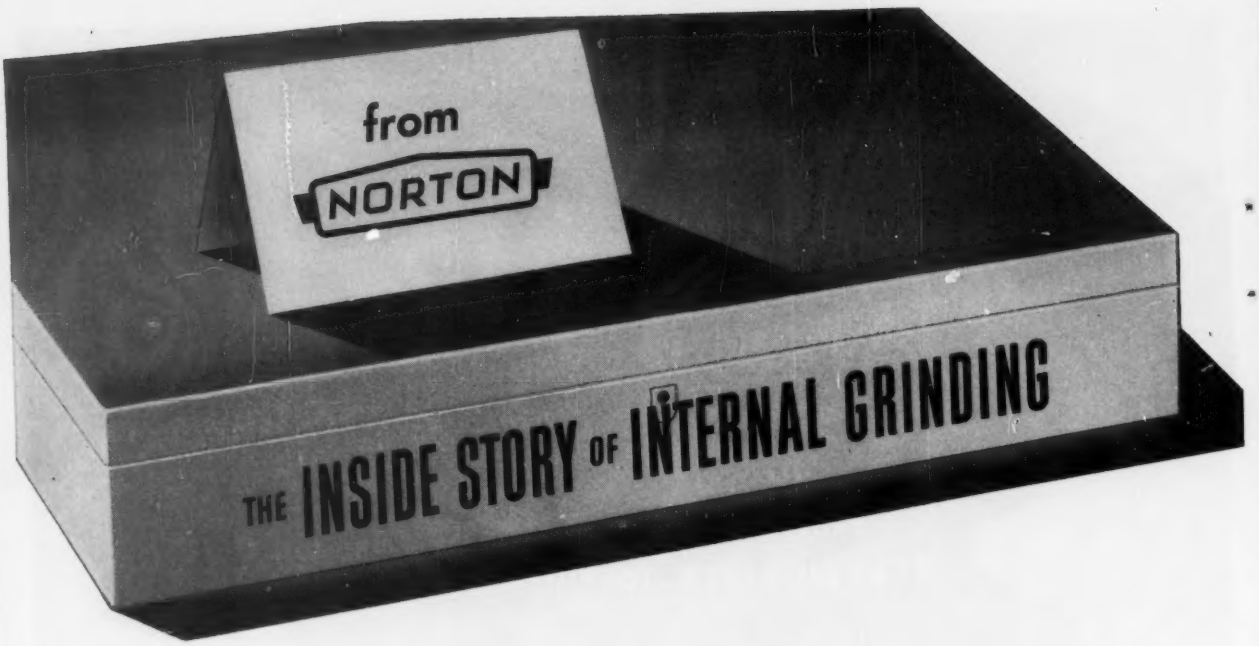
Company_____

Address_____

City_____ Zone_____ State_____



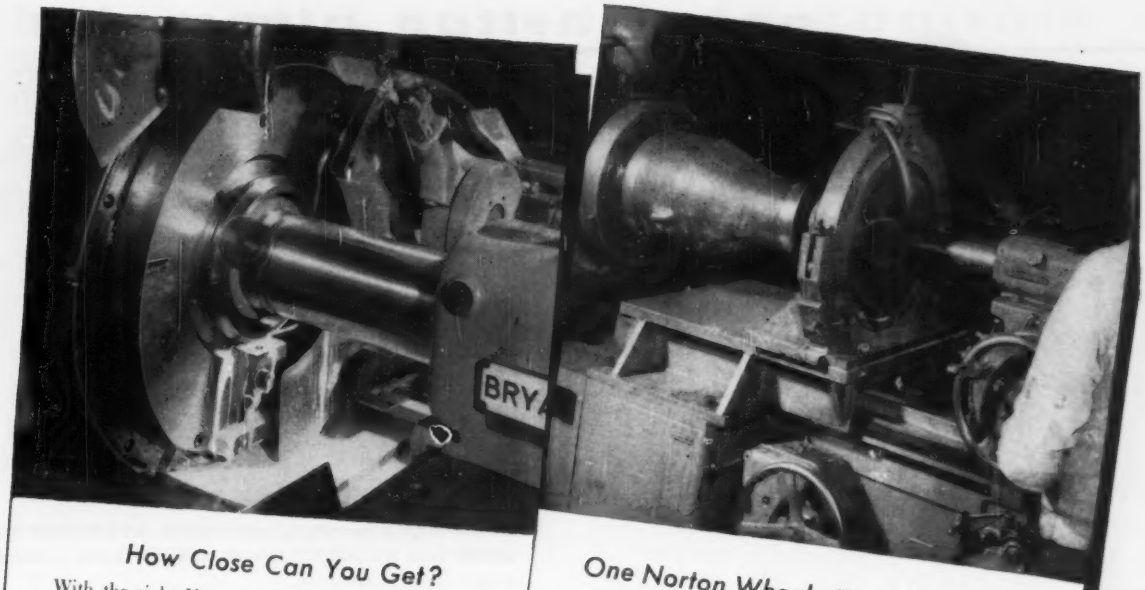
How Norton wheels add the **"TOUCH of GOLD"** *across the range of internal grinding jobs*

Take a Good Look at Precision

It's easy to see why Norton internal grinding wheels are such outstanding precision performers. They're precision-built, by an exclusive process that results in absolutely uniform grinding action in wheel after wheel of the same specifications. This means that when you change wheels you have no adjustments to make, the new ones give you the same fast, cool-cutting performance. And you can add this time-saving, productimproving "Touch of Gold" to every internal grinding job you do, because Norton wheels are made in types and sizes for every application.

The G Bond Has No Equal

No other vitrified bond ever developed can match the Norton G Bond for efficiency and economy in precision and semi-precision grinding applications. It holds abrasive grains until each has done its full share of the work, keeping the wheel's cutting surface at constant peak efficiency. That's why G Bond wheels cut freer and faster; produce finer finishes, dress easier and do more work per dressing and per wheel. On many jobs the G Bond and 32 ALUNDUM* abrasive — recommended for heavy feeds and fast stock removal — make the ideal "Touch of Gold" team for profitable precision grinding.



How Close Can You Get?

With the right Norton wheel you meet closest tolerances in the shortest possible time. The performance data on this precision job tells you why. The Norton wheel is grinding an inner bearing race of 52100 steel. *I.D.:* 5.5118". *Stock removal:* .005" to .007". *Limits:* +.0000", −.0001". *Finish:* 10 microinches RMS. *Time:* 90 seconds.

One Norton Wheel—Two Good Jobs

In grinding this trunnion, one Norton wheel is used on both ends. Material is stainless steel No. 304. The larger hole measures 13 1/16" I.D. x 4" long; the smaller is 5 1/2" I.D. x 4" long. Stock removal from each end is .015", to tolerance limits of ±.0002". Four complete trunnions — eight grinding jobs — are done each day.

A Mighty Fine Finish

This Norton wheel is grinding a bearing sleeve of 52100 steel, 62 to 63 Rockwell C. The hole is 3 1/4" I.D. x 4 23/32" long. From .005" to .006" of stock is removed, within limits of +.0008", −.0000". The surface is finished to 4 microinches RMS and grinding time is 30 minutes each.

Ask Your Norton Distributor

to arrange a test of these top-performing "Touch of Gold" internal grinding wheels in your plants. Or write direct to your nearest Norton district office. And remember: only Norton offers you such long experience in both grinding wheels and machines. NORTON COMPANY, Worcester 6, Mass. Offices in nine cities. Distributors in all industrial areas — listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning, Troy, N.Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1686

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON

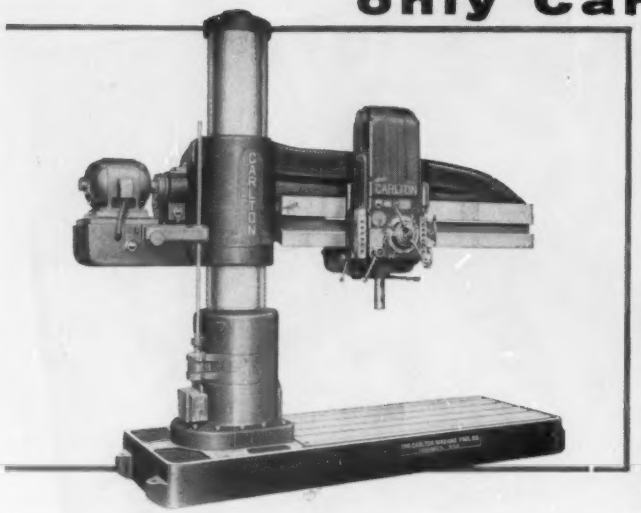
ABRASIVES

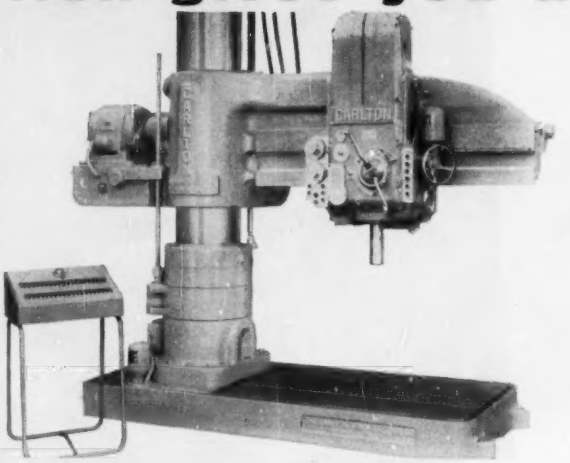
Making better products...
to make your products better

NORTON products: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING products: Coated Abrasives
Sharpening Stones • Pressure-Sensitive Tapes

only Carlton gives you a





1. Programming and pre-selector gear shift sets up correct speeds and feeds for a complete sequence of operations.

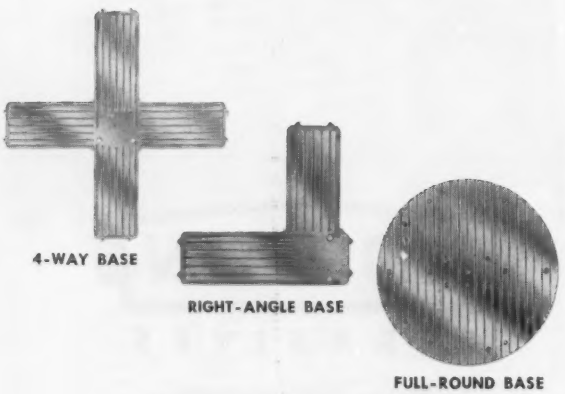
With the introduction of the new Carlton-Leber speed-feed programming and pre-selector systems, you can now take your choice of three speed-feed controls: programming, pre-selector or manual.

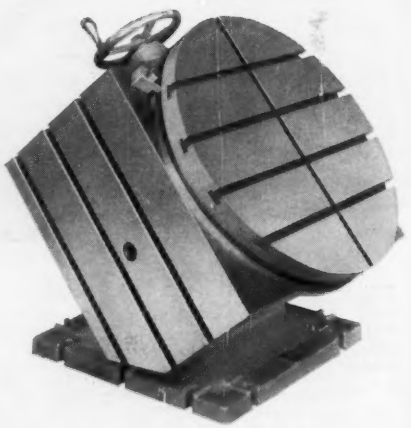
Programming works like this: your production engineering department studies the workpiece drawing and determines the sequence of drilling operations and the correct speed and feed for each. This data is recorded on a routing sheet or blueprint and is transferred to the programming console.

The programming console contains an indexing dial which shows the operation sequence number being performed. Operator has local control and can perform operations out of sequence by manually advancing or reversing the indexing dial.

Pre-selector: For less lengthy or complicated drilling jobs, the programming unit can be disconnected through a selector switch and the pre-selector then becomes operative. The pre-selector saves time by allowing operator to select speed and feed for the next operation while the machine is under cut. Pre-selector may be furnished with or without the programming unit.

and special bases, tables and

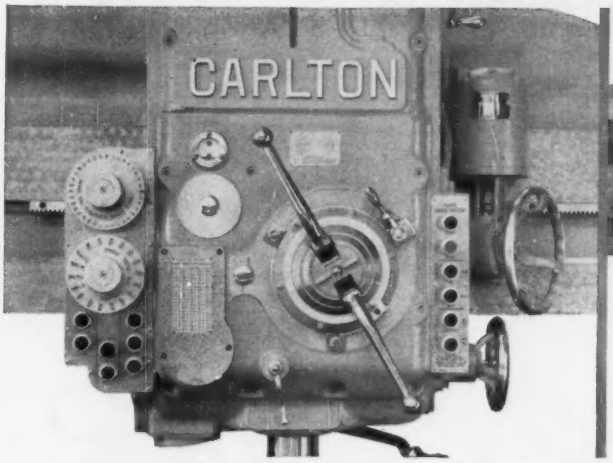




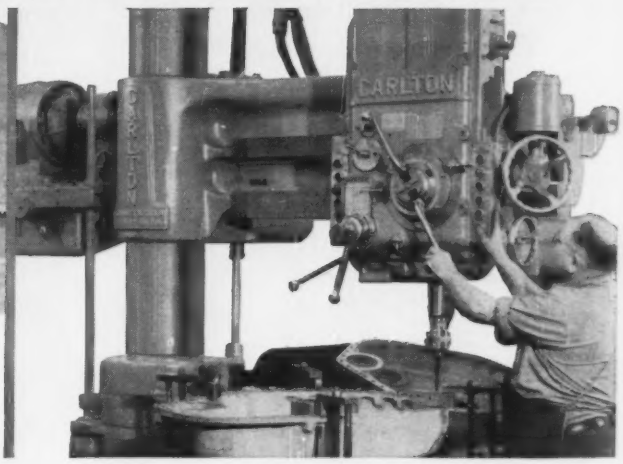
Special bases: Carlton radial drills can be furnished with any of seven different types of stationary bases (three of which are shown above). In addition, special track type mounting and sliding bed plate base also available.

Special tables: Plain, uni-tilt and full universal tables available as extra equipment. The universal table shown above is Carlton engineered and built, is fully universal and has a 32″ round top.

choice of 3 speed-feed controls



2. Pre-select gear shift: 1 speed graduated dial and 1 feed graduated dial pre-set speeds and feeds.



3. Manual gear shift: 2 shifter levers for controlling speeds, 2 shifter levers for controlling feeds.

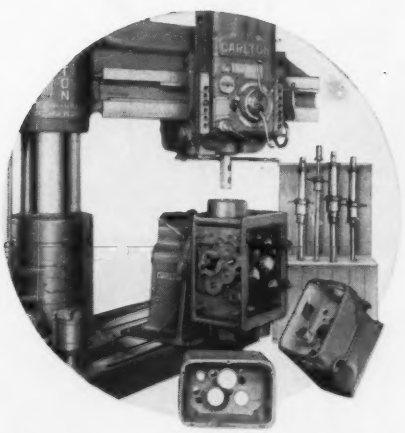
Manual gear shift: Selects speed-feed combinations in the conventional manner—manually, one at a time, using two speed shifter levers and two feed shifter levers.

Carlton gives you a wide choice in radial drill selection . . . not only in speed-feed control systems, but also in size and capacity. You're sure to find your most economical drill size at Carlton, because the broad Carlton line includes arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. For the complete range of sizes, send for descriptive literature.

Carlton also gives you the advantage of a wide selection of special bases, tables and jigs and fixtures (see below). A capable sales-engineering staff will study your requirements and submit without obligation a recommended tooling set-up that's best for you.

Carlton has just published a new 24-page booklet presenting the most modern concept on how you can get better, more efficient, lower cost drilling. Why not write for your free copy today? The Carlton Machine Tool Co., Cincinnati 25, Ohio.

jigs for additional productivity

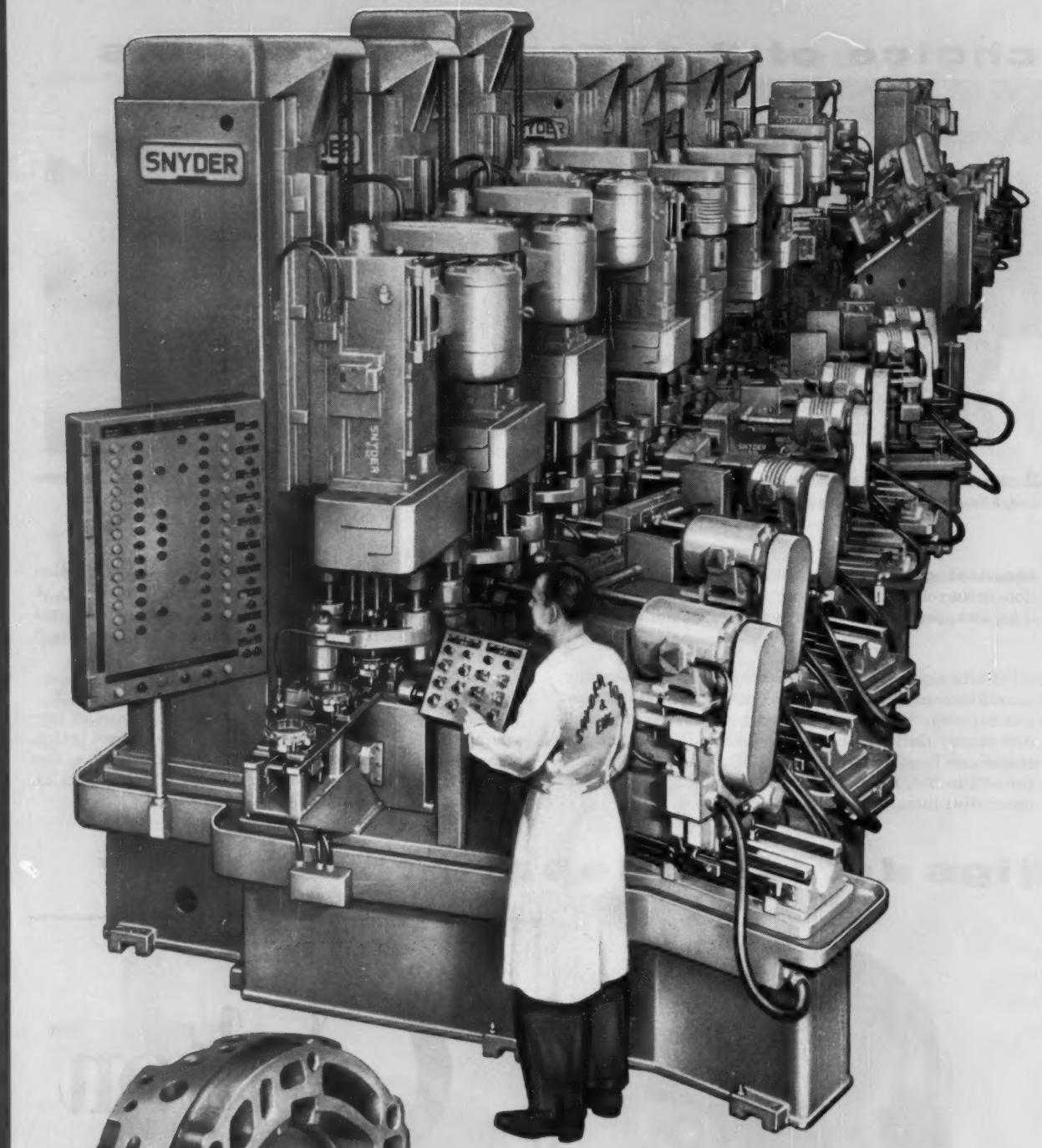


Special jigs: Carlton engineers will be glad to recommend the most efficient tooling for your requirements. The set-up shown above reduced running and set-up time from 7 hours down to 5.25 hours. Includes master trunnion, jigs and boring bars.

Carlton

horizontal and radial drills

For more information fill in page number on Inquiry Card, on page 255



An individual station is provided for ejecting parts when the first section of the machine is operating and the second section is down for tool changes. Also shown is the turnover mechanism which turns the part through 180 degrees for operations on the other side. ⟶

SNYDER SEGMENTED AUTOMATION in 23 segment, 75 station, in-line, transfer machine permits part design flexibility, conversion to processing similar parts, limited obsolescence; drills, reams, spotfaces, chamfers, bores, counterbores, mills, taps, and automatically air gages work on automatic transmission front oil pump bodies at 144 pieces an hour at 80% efficiency.

SNYDER

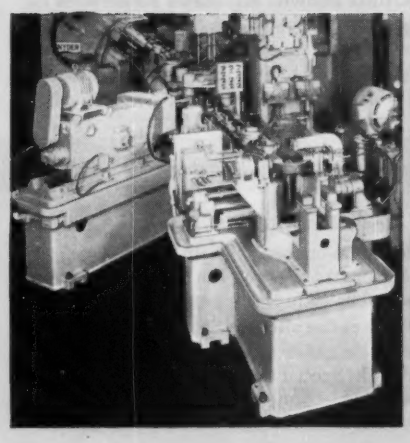
TOOL & ENGINEERING COMPANY

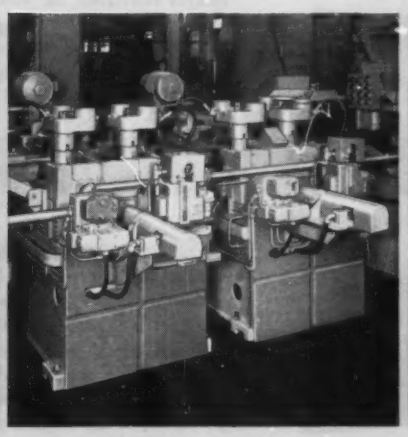
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

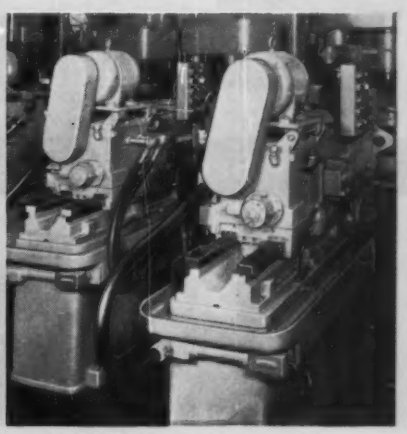
31 Years of Special Machine Tools with Automation

Segment bases are designed for mounting units for future operations, a feature of the flexibility and convertibility of the machine.

Each segment has individual push button station. Note the accessibility of tools.



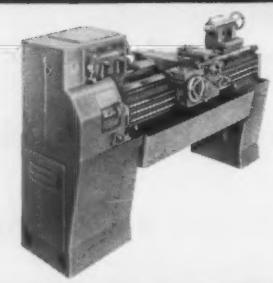




The Right Lathe for You from LeBlond's Complete Line...

Regal Lathes

Dependable Performance at Low Cost



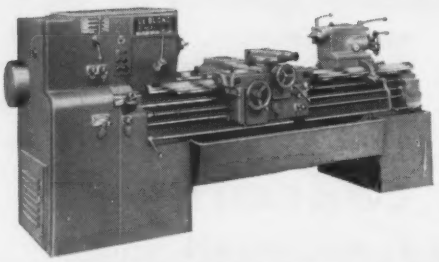
13", 15", 17", 19", 21", 24"; 2 to 5 horsepower

Designed and built like heavy-duty lathes, the new LeBlond Regals will give you a long life of precision production, minimum maintenance and the kind of dependability you'd expect from a much higher-priced machine!

Major features: Hardened and ground replaceable steel bed ways. Combination gear-belt drive headstock. *Both* feed rod and leadscrew. 3-bearing spindle. Advanced styling. Plus general construction details patterned after LeBlond heavy-duty lathes.

Small Heavy Duty Lathes

Stamina Plus with Precision



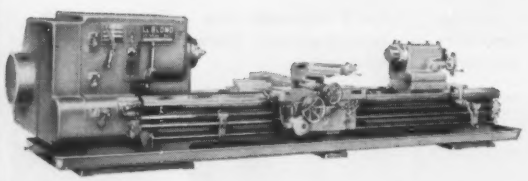
12", 14", 16", 20"; 7½ to 20 horsepower

LeBlond heavy-duty engine lathes have always been known for their outstanding stamina—the ability to stand up to the toughest turning jobs with precision, year after year. Our new machines in this class are the most rugged, yet precise that we've ever built!

Major features, 16" machine shown: Single-lever, four-way power rapid traverse built into the one-piece apron. Combination gear-belt drive headstock with 27 speeds from 16 to 2000 rpm. Totally-enclosed quick-change box. Hardened and ground replaceable steel bed ways. Automatic lubrication.

Large Heavy Duty Lathes

Heavy Hogging or Fine Finishing with Ease



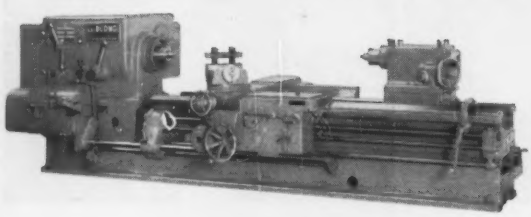
25", 32", 40", 50"; 50 and 60 horsepower

When large-swing work is in your production picture, check these big LeBlonds. Whether you need real high power, contoured shapes or fine finish, LeBlond offers the utmost in dependability, speed and easy operation.

Major features, 32" machine shown: Adjustable acceleration for starting, stopping, jogging provides true safety. 36-speed headstock, spur gear design for the lowest no-load friction horsepower. Four-way power rapid traverse (six-way on 40s or 50s). Generous proportions throughout for long-lived stamina and precision!

Sliding Bed Gap Lathes

Maximum Versatility with Dependability



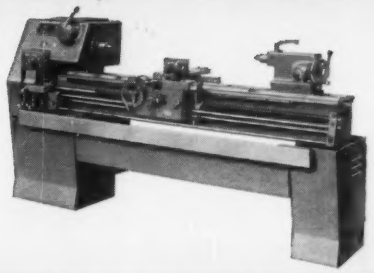
16"/38", 25"/50", 32"/60" Heavy Duties; 17"/28" Regal

Lathe department all rolled up in one machine! In addition to regular turning, facing, chasing, tracing, you can handle odd-shaped or large-diameter work as well as extra-long pieces.

Major features, 25"/50" machine shown: Sliding upper bed moves easily to provide variable gap or capacity for extra length. 36-speed high-power headstock. Special one-piece apron with extended length handwheel brings cutting tool close to gap. Four-way power rapid traverse.

Dual Drive Lathes

Best Buy for Medium-duty Turning



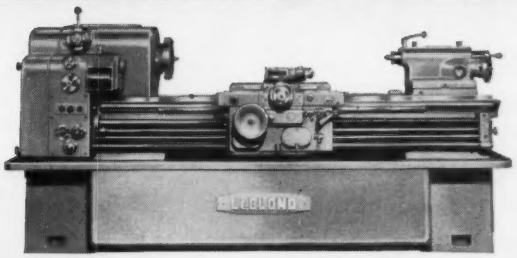
15"; 5 horsepower

Dual Drive gives you efficient capacity for the great proportion of your lathe work. Smooth and powerful spindle speeds satisfy all requirements up to those requiring a heavy-duty machine. Precision production at moderate cost!

Major features: Single-lever choice of 16 spindle speeds from 31 to 2400 rpm through combination gear-belt drive headstock. Hardened and ground replaceable steel bed ways. Totally-enclosed quick-change box. Automatic lubrication. Double-wall, one-piece apron.

Model RT Toolroom Lathes

The Ultimate in Precision, Convenience, Versatility



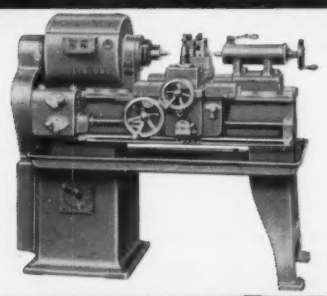
16"; 7½ horsepower

Even today, other lathes can't match the advanced designs pioneered by LeBlond in the RT Toolroom Lathe. When it comes to producing a wide variety of fine toolroom work, no other lathe can match the convenience, precision and speed of the RT.

Major features: Infinitely-variable spindle speeds from 6 to 1500 rpm by a single lever. Universal quick-change box provides 90 feeds and threads. Four-way power rapid traverse. Combined feed apron cuts steep tapers. Automatic chasing stop limits cross slide travel, saves time in chasing threads.

Rapid Production Lathes

Best for Low-cost High Production



13", 17", 21"; 3 to 10 horsepower

Not a stripped down engine lathe, RP is designed to give you high production for a variety of work within a range you choose. A great number of productive attachments are available to suit your special needs.

Major features, 13" machine shown: Choose from three headstocks that give you speeds as low as 68 rpm and as high as 3600 rpm. Hardened and ground replaceable steel bed ways. Automatic lubrication to headstock and feed box. Heavy-duty carriage and apron.

LeBLOND also Builds:

Plain Bed Gap Lathes.....12", 14", 16", 20", 25", 32"

Hollow Spindle Lathes.....16", 20", 27", 30"

Toolroom Lathes.....12", 14", 16", 20"

Standard Duty Lathes.....20", 25", 32", 40"

Crankshaft Lathes.....Automatic—for any crank

Cutter Grinder

Hydra-Trace*
Duplicating Attachment...Fits most LeBlonds built since 1935

*Trade Mark Reg. U. S. Pat. Off.

LeBLOND of Cincinnati

Write for complete catalog C-56 D

The R. K. LeBlond Machine Tool Company *Cincinnati 8, Ohio*

World's largest builder of a complete line of lathes for more than 69 years

Representatives in principal cities throughout the world

CINCINNATI RIGID SHAPERS

New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

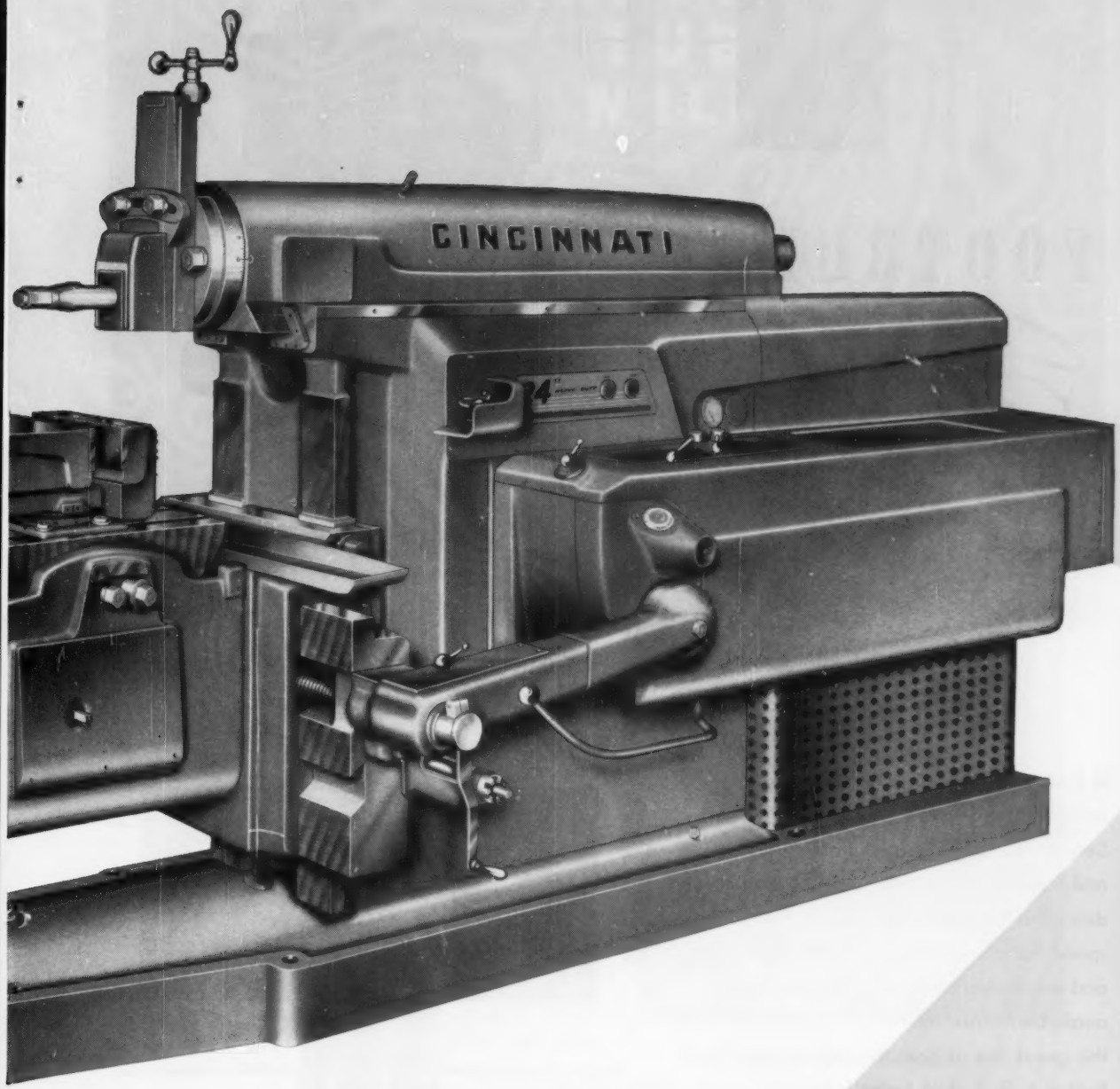
50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

Write for the circular on the New Rigid Shapers.

Nodular iron, slot-free ram

Electro-magnetic Clutch and Brake

The only shaper with 50 P.S.I. lubrication



Cincinnati Shapers, Shears and Press Brakes carry a 5 year guarantee on workmanship and material—write for details.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

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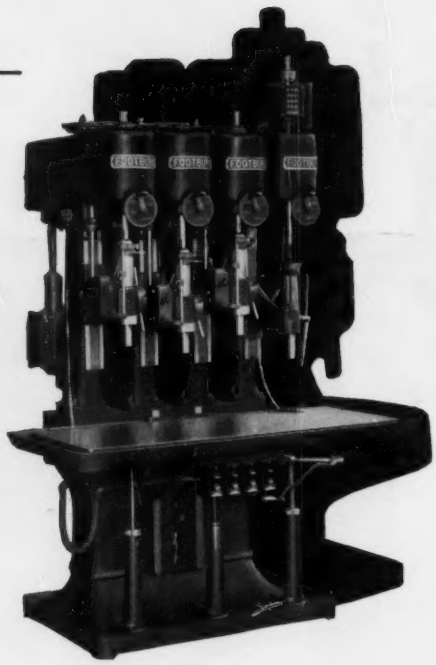
FOOTBURT

Sensitive

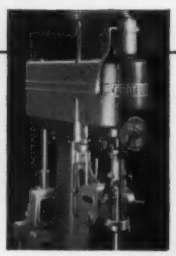
DRILLING MACHINES

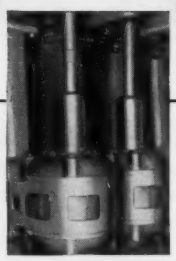
A FULL RANGE DRILLING MACHINE ENGINEERED FOR PRODUCTION

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.



■ No. 2 Machine with Back Gear • 12″ Overhang • ⅝″ Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.



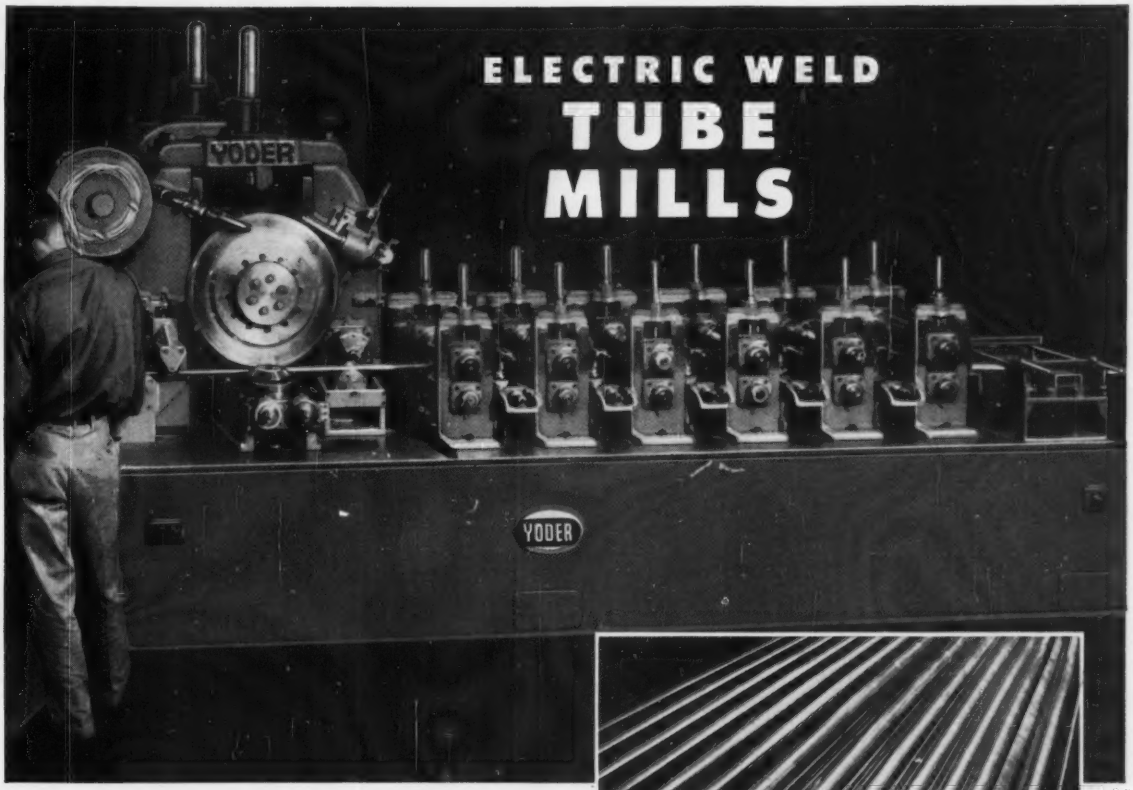


THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

engineered for production

FOOTBURT

MACHINE TOOLS



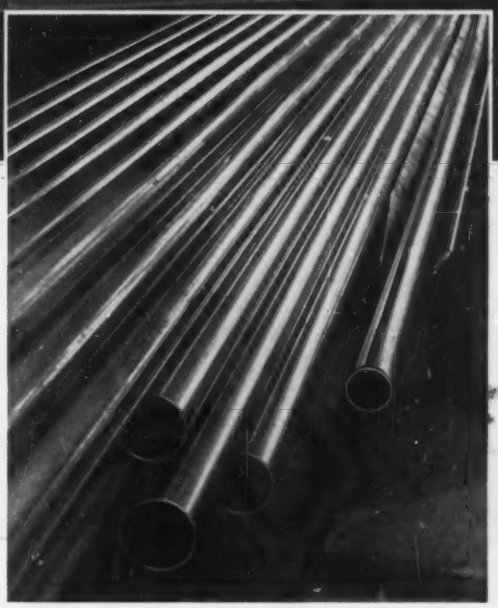
The photo shows the tube forming mill and welder of a complete Yoder mill recently installed for an Italian customer. Although it looks very much like a standard Yoder mill, it embodies special mechanical and electrical innovations designed for *tube production at speeds up to 350 fpm*—from 200 to 300% faster than heretofore considered practical by the resistance-weld process.

This is just one example of the many new things introduced by Yoder in pipe and tube making equipment, to meet widely varying production needs. Other recent Yoder developments are induction weld mills for making steel as well as nonferrous pipe and tubing, at speeds never before approached by this process, and adding greatly to its recognized economic advantages.

For more complete information about the latest technological advances in Yoder tube mill equipment, write, wire or phone

THE YODER COMPANY

5504 Walworth Ave. • Cleveland 2, Ohio



Literature on Request:

- ☐ **1.** Electric Weld Tube Mills for *Steel Tubes* up to 4" diameter.
- ☐ **2.** *Induction Weld* Tube Mills—sizes up to 8" diameter for aluminum, nickel, copper, brass, inconel, monel, stainless and other alloys.
- ☐ **3.** *Pipe Mills*—electric weld—for sizes up to 24" diameter.

ENGINEERING YODER MANUFACTURING

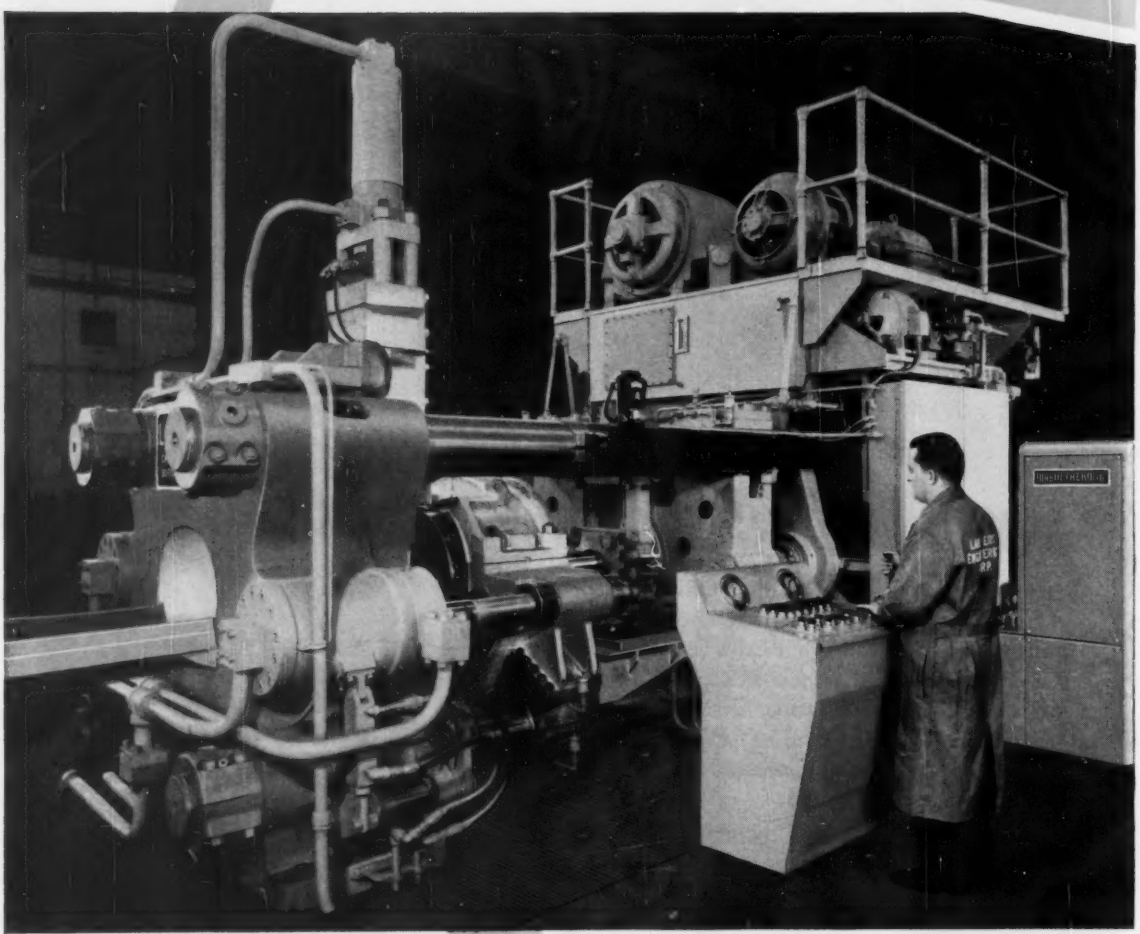
PIPE AND TUBE MILLS—Electric Weld

ROTARY SLITTING LINES

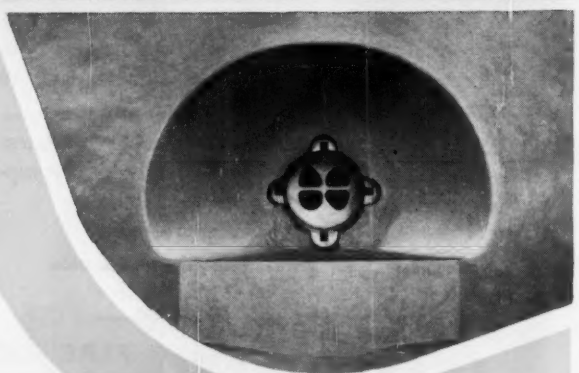
COLD ROLL FORMING MACHINES

For more information fill in page number on Inquiry Card, on page 255

SEE THIS PRESS



This new design in extrusion presses has many vital points of superiority. For example, the container holder is designed to maintain alignment regardless of thermal expansion. This gives you longer tool life and better quality extrusions. In addition, the container has sufficient stroke to accommodate bridge-type porthole dies and allows ample space for spraying the die. Other noteworthy features are a loader mounted on the container holder . . . an independent loader finger that pushes the billet and dummy block into the container . . . and safety interlocks that prevent the press from operating unless the dummy block is in place. The press can be furnished for operation or loading from either side as required.

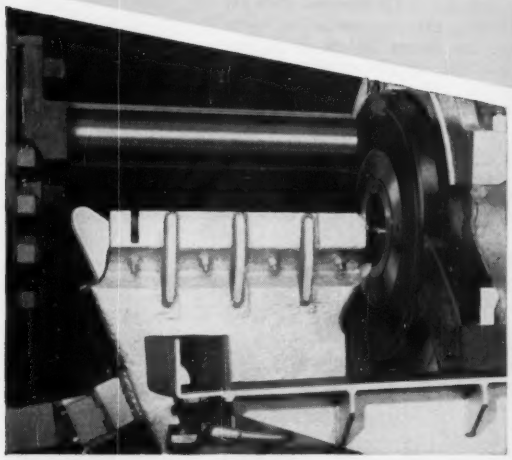


RUNOUT OPENING is machined for insertion of carbon canister. The canister guides the extrusions through the platen to assure a superior finish.

EXTRUDING

...right in your own office

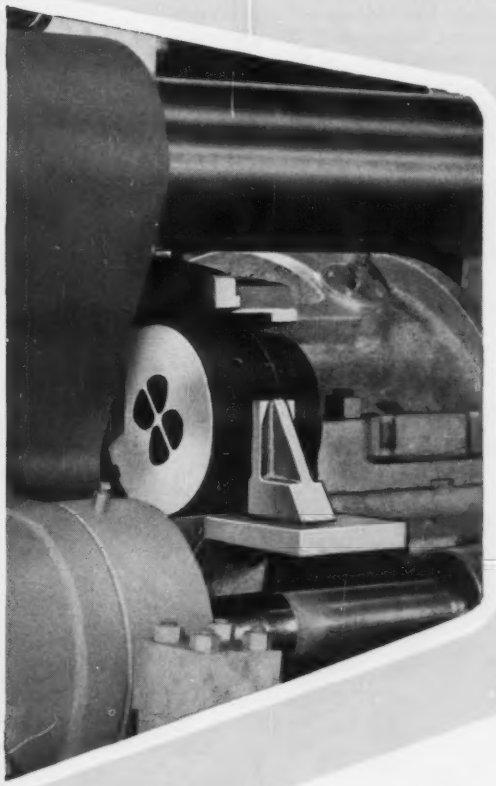
Features long needed at last available. Here is an extrusion press that will put you miles ahead of your competition in today's market. Equally important, it is built to produce the newer types of extrusions that will be in demand in tomorrow's market. You can see this press operating right in your office by sending for our 16 MM sound, color film, "Pressure on Extrusion Production." Running time 25 minutes.

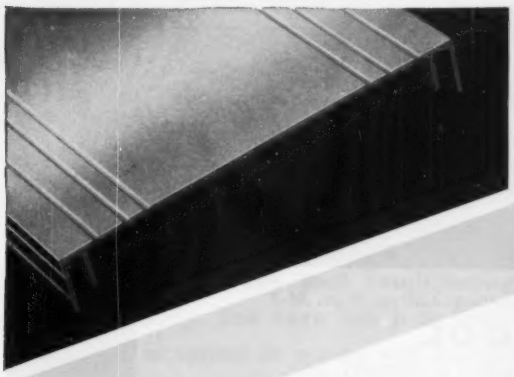


ABOVE: The greatly simplified billet loader speeds the movement of billets and dummy blocks into the container. It performs this operation automatically and independently of the stem. It then withdraws, permitting the stem to move in rapidly and without interruption.

RIGHT: The patented swinging arm die holder is a major improvement over the old style die runout and slide. It saves floor space, speeds die changing, and simplifies die cleaning and inspection by providing a clear view through the die.

BELOW: Extreme-width extrusion produced from rectangular billet.





LAKE ERIE HYDRAULIC PRESSES

Full line of Standard Ferrous and Non-Ferrous Extrusion Presses.

•

Complete Extrusion Plants

•

Leasing and Deferred Payment Plans Tailored to Your Exact Needs.

LAKE ERIE ENGINEERING CORP. *General Offices and Plant: 470 Woodward Ave., Buffalo 17, N. Y.*
District Offices in New York, Chicago, Detroit, Pittsburgh
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LAKE ERIE®

BURGMASTER® AUTOMATIC HYDRAULIC TURRET DRILLS

with Power Indexing produce a "higher level of quality" at Bendix Aviation Corp., Bendix Products Div., South Bend

They have this to say at Bendix, South Bend where 20 Burgmaster 6 spindle 2BH turret drills are effectively performing numerous secondary operations on aircraft parts—

"The work performed on the Burgmaster 2BH Models was previously run on 6 spindle hand-fed upright drill presses. The benefits derived over the old method of machining are:

1 *With the drill fixture clamped in alignment under the spindle, a higher level of quality can be maintained and repair work has dropped to a minimum.*

2 *Operator performs work with less fatigue.*

3 *The uniform hydraulic feed enables us to produce better finishes and size."*

Machine tool users everywhere are experiencing these and additional benefits such as: simplified fixturing, extreme versatility—jobs formerly done on turret lathes, chuckers, hand screw machines can be done with ease on the Burgmaster; low initial cost, low maintenance, little floor space required. They are finding that here, in one highly versatile machine, drilling, reaming, counterboring, countersinking, spotfacing, tapping, O.D. threading and many other operations can be accomplished with more accuracy—with one operator.

Automatic hydraulic Burgmasters (6 and 8 spindle models) feature skip indexing, automatic cycling and infinitely variable pre-selective feeds. All models (including the 6 spindle manuals) provide power indexing, pre-selective spindle speeds and very close pre-selective depth control.

For complete information, address Dept. M-3

BURG TOOL

Manufacturing Company, Inc.

15001 South Figueroa Street, Gardena, California

Sales Offices:

New York • Chicago • San Francisco

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CHICAGO International Amphitheatre • March 19-23

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Charlie Middleman, Foreman, says:

"I LIKE GEOMETRIC DIE HEADS because . . .

. . . there is practically no down time for changing chasers. Our chasers are resharpened in the tool conditioning department so we always have sharp sets handy. Joe here has just finished a new setup. He took out the old chasers, snapped in a new set and adjusted them to size on a sample work piece in 2 minutes flat!

Supermetric chasers? We like them fine. We get lots more pieces and better threads with them."

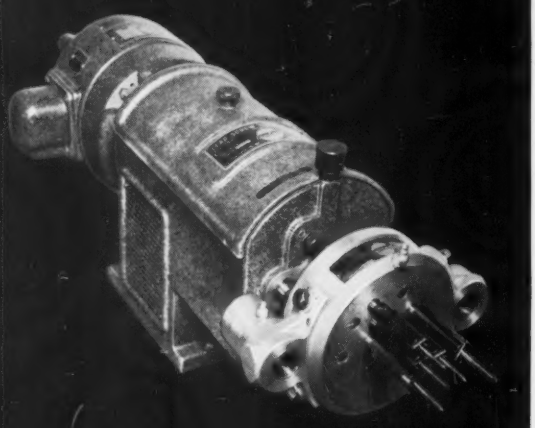
Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

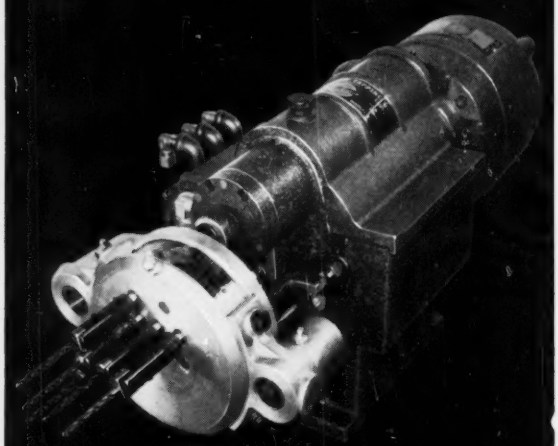
GEO MET RIC

THE A.T.U. TAPPING UNIT



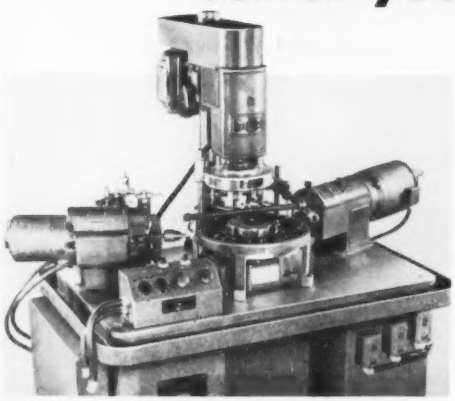
Completely self-contained all-electric lead screw unit for single or multiple tapping

THE A.D.U. DRILLING UNIT



Self-contained air-driven unit with sensitive electric control for single and multiple drilling

NEW ETTCO'S Tapping and Drilling Twins ... the versatile combination that solves your small hole problems



A high-production, special purpose combination drilling-tapping machine built entirely from standard Ettco units and components.

NOW—two separate self-contained, built-for-the-purpose units that meet most single or multiple drilling and tapping requirements.

Both units have been designed for extra power, speed and rigidity to insure greater precision at high production rates.

Ettco's Tapping and Drilling Twins are available as individual units or as standard upright machines. They can also be built into automatic drilling and tapping machines simply by mounting them in any desired combination on a standard base. ***Write for details — today.***

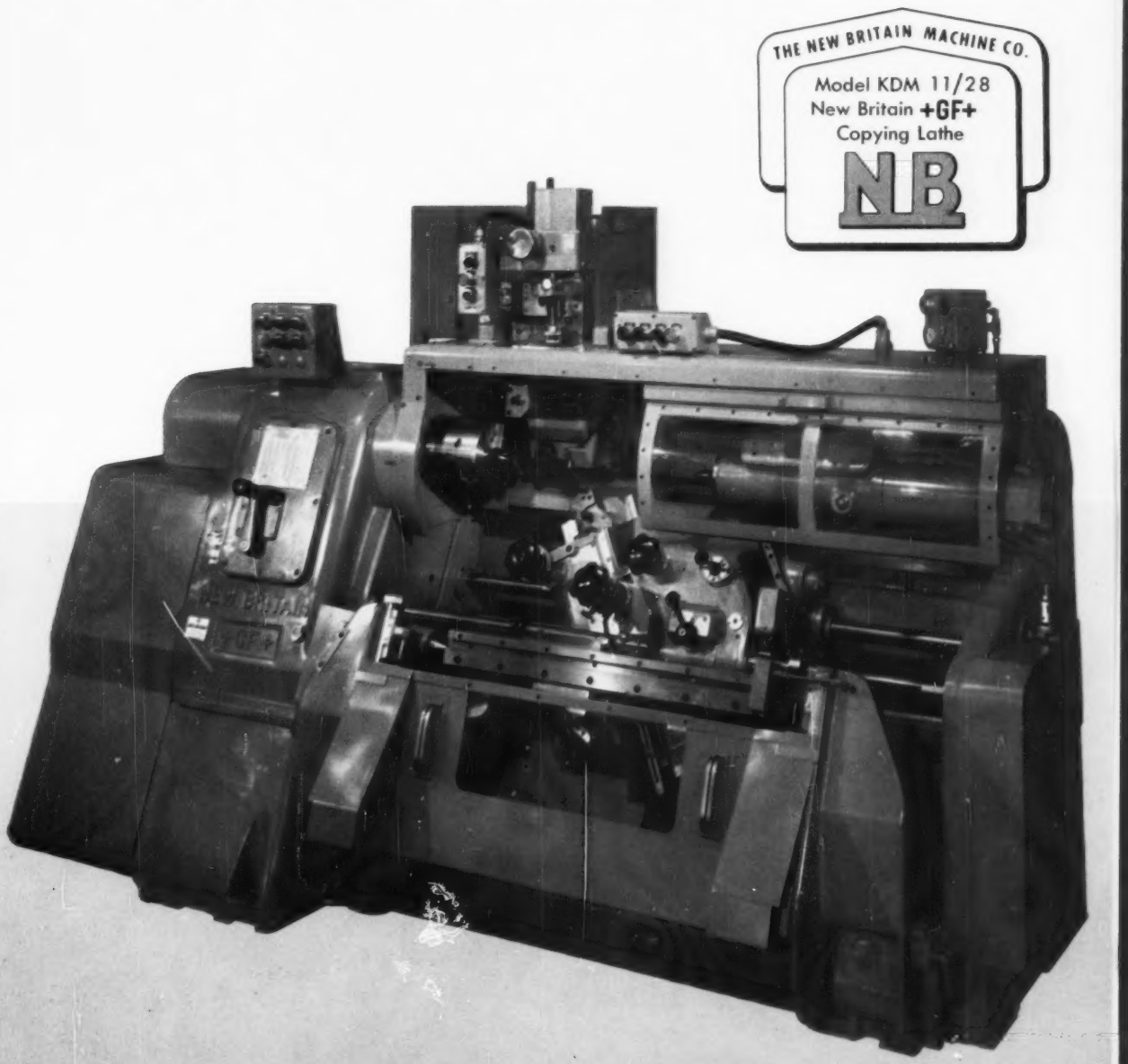
"See your Authorized Ettco Distributor."

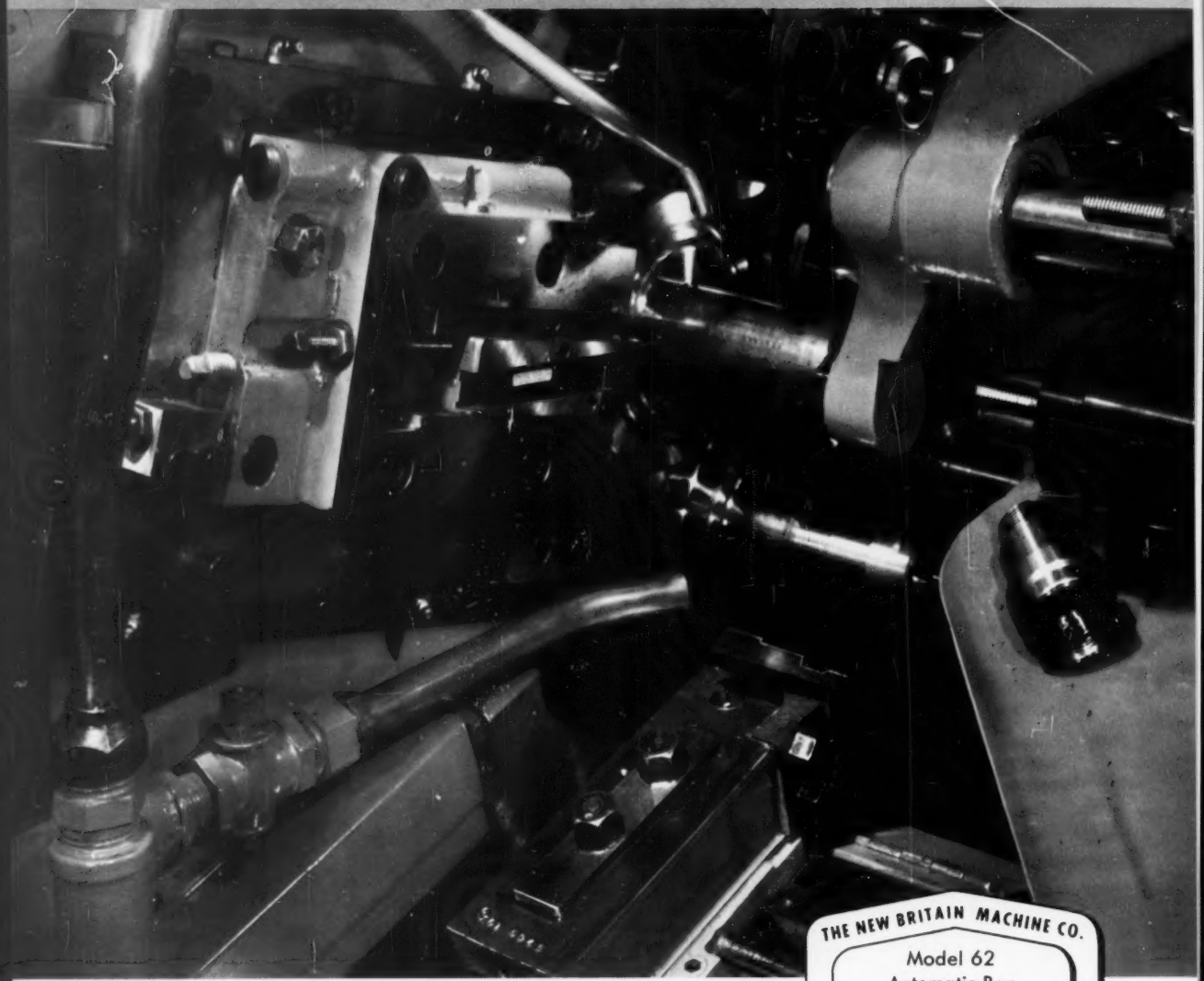
ETTCO TOOL CO., Inc.
592 Johnson Ave. Brooklyn 37, N. Y.
Chicago • Detroit • Los Angeles • Indianapolis

Ettco-Emrick the right equipment for every small hole drilling and tapping need.

everywhere you turn...

You'll find New Britain **+GF+** Copy Lathes are turning out pieces at profit. With a 15-minute setup on a standard model to make just a few pieces, or with an automatically loaded production model to run a million a year, the New Britain **+GF+** approach can make money for you. For a complete color motion picture demonstration in your office, consult your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.





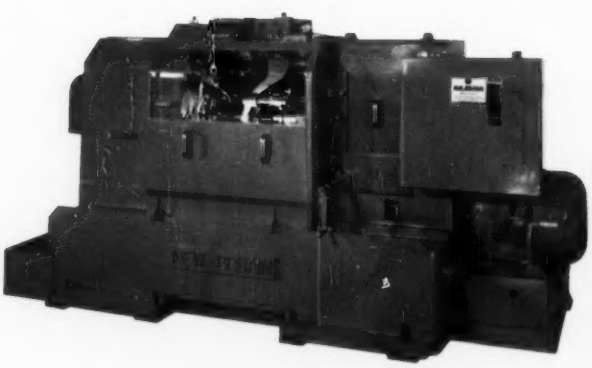
THE NEW BRITAIN MACHINE CO.

Model 62
Automatic Bar
Machine

NB

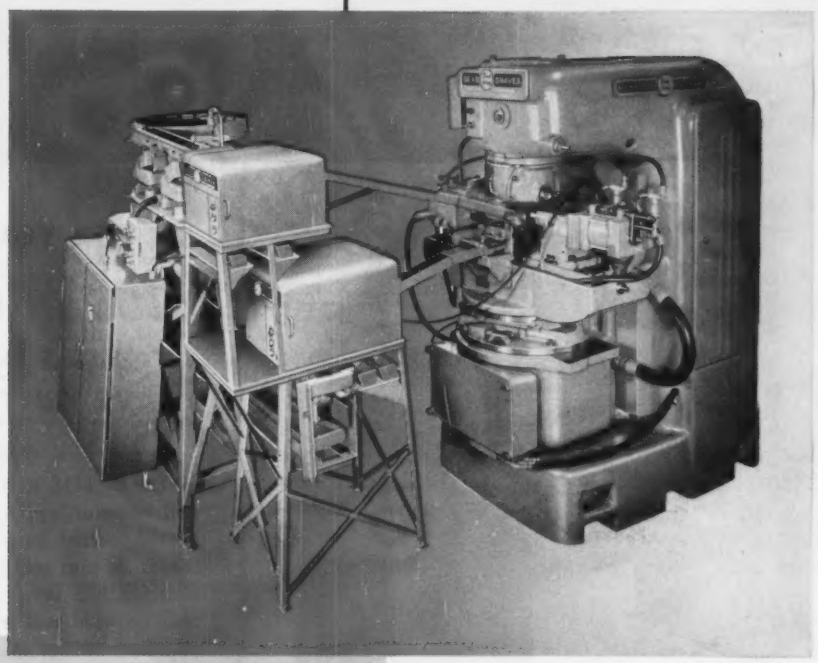
a rugged cross slide in every position

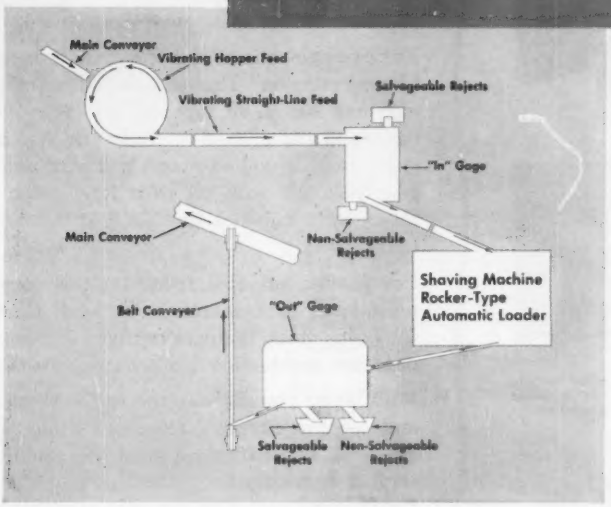
New Britain Models 60 and 61 Automatic Bar Machines are everywhere you turn. The new Model 62 represents new progress in rugged construction and versatility of setup. Your New Britain Representative can show you how to modernize at a profit. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



FOR MINIMUM COSTS

SHAVE GEARS AUTOMATICALLY





This is fully automatic Red Ring gear finishing.

Cut gears come in on a conveyor to the storage and feeding mechanism. This may be a vibrating hopper, overhead chute or other device.

These gears are fed into an "In Gage" which screens out undersize and greatly oversize parts, passing only those within tolerance to the Shaving Machine.

After shaving, the gears then go through the "Out Gage" where they are checked for size and helix angle—again screening out the rejects.

Whenever the percentage of rejects goes beyond a selected amount the gage shuts down the shaving machine and indicates by signal lights the nature of the difficulty.

WRITE FOR COMPLETE DETAILS

NATIONAL BROACH & MACHINE CO.

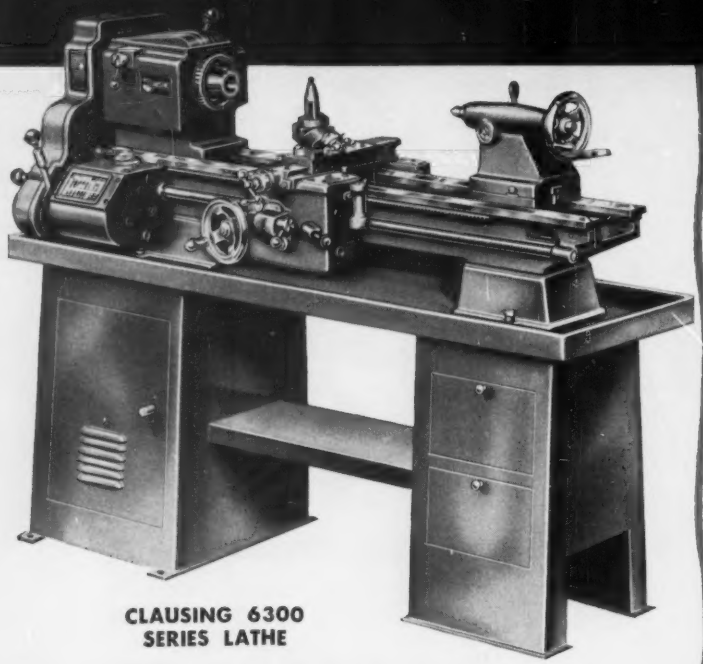
5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

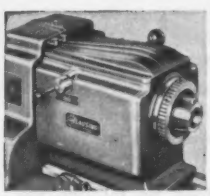
7381

For more information fill in page number on Inquiry Card, on page 255

Come · Compare and See CLAUSING at



CLAUSING 6300 SERIES LATHE

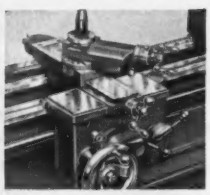


FULLY ENCLOSED HEADSTOCK

Spindle turns on widely-spaced "Zero-Precision" Timken tapered roller bearings with tolerance of .00015".

ENCLOSED OUTBOARD DRIVE

With dual-belt outboard drive, replacing belts is a quick, easy job — no need to disassemble headstock and spindle. Variable speed drive optional.



DOUBLE-WALLED APRON

Thick-walled apron is fully enclosed. Has built-in safety lock, oil bath lubrication.

CLAUSING 6300 CONDENSED SPECIFICATIONS

CAPACITY Swing: 12¾" over bed; 12⅜" over saddle wings; 7⅜" over saddle. 21½" - 33½" - 47" between centers. Beds: 47" - 59" - 72½".

BED: 7⅜" wide, 5⅛" deep. Two Vee, two flat ways and underside of bed are precision ground.

THREAD RANGE: 48 selections, 4 to 224 Standard, right or left.

SPINDLE SPEEDS: Countershaft Drive, 8 (50-1300 R.P.M.) Variable Speed Drive, Infinite (30-1400 R.P.M.)

POWER LONGITUDINAL FEEDS: From .00065" to .0367" (left or right) per revolution of spindle.

TAILSTOCK: 1⅜" diam. ram, 3" travel. Ram graduated 0 to 3" by 1/16ths. No. 3 Morse Taper. 1" set-over.

SEE FOR YOURSELF THE MANY *PLUS VALUE FEATURES*

AVAILABLE ONLY IN CLAUSING HEAVY DUTY MACHINE TOOLS

In Booth 1418 at the ASTE Exposition you will have an opportunity to see for yourself the important basic design superiorities, performance and safety features that have made CLAUSING lathes, power-feed drill presses, and vertical millers far and away the outstanding values at or near their price.

For example, the 6300 lathe spindle turns on "Zero-Precision" Timken tapered roller bearings and has L-00 tapered key-locked nose, hardened and ground . . . fully enclosed headstock, double walled apron and quick-change gear box, *all* with oil bath lubrication . . . heavy duty tailstock has No. 3 M.T. ram with tang socket.

For production, tool room, maintenance, experimental or research work such CLAUSING plus value features as these will improve precision production while cutting costs.

We suggest you come to the ASTE Exposition and see the exacting tolerance limits which every CLAUSING must meet. We *invite your critical* inspection!

Write **for FREE SHOW TICKETS**

We will gladly send you a complimentary admission ticket to the ASTE Exposition to save you all registration delays.

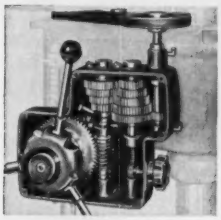
Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY KALAMAZOO, MICHIGAN U.S.A.

CLAUSING DIVISION

Draw your own **Conclusions!**

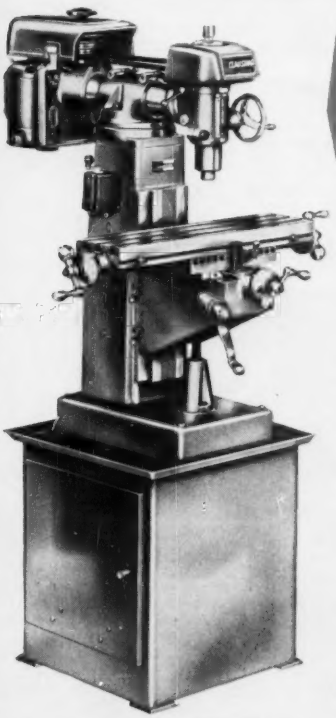
the **ASTE Exposition**

CLAUSING 18" DRILL PRESS



CLAUSING POWER FEED
The heavy-duty gear driven power feed is positive and sure with no belt slippage to dissipate power. Feed selection is instant, by dial. Gears run in bath of oil.

The new Plus Value CLAUSING 18" Drill Press is setting new standards in tool and job capacity and performance. With Power Feed it is the outstanding value for heavy-duty production, tool room or general drilling operations. The 6½" spindle travel gives bigger job capacity, permits better use of production chucks. Drilling capacity: ¾" in steel, 1" in cast iron. Spindle nose is No. 3 M.T., handles larger tools. Exclusive vernier control provides .001" depth accuracy. Positioning mechanism saves set-up time — moves *both* head and table. Massive construction, precision-machining throughout, and the smoothness of 5 ball bearings insure exacting accuracy on every operation. Be sure to see this great drill press at the ASTE Exposition!



CLAUSINGS ARE EXTREMELY ACCURATE

Every CLAUSING MILLER must pass rigid tolerance tests — such as:

1. Top of table perpendicular to column ways, both directions, within .0005" in 8" travel.
2. Table top, front to back, square with column ways 0 to .001".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.T. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

NOW ONLY $795.00 FACTORY

CLAUSING VERTICAL MILLER

The new CLAUSING Vertical Milling Machine mills, drills, bores, reams and shapes . . . at all angles with one work setup. It offers more PLUS Value features than have ever before been available in a miller at or near its price. Actually, it is several machines combined in one.
Features include: precision spindle head with 7 ball bearings. Quill is hardened and ground . . . bearings for quill are *honed*. All feed screws have ground threads, turn on ball bearings. Table surfaces and dovetail ways on table, saddle, knee and column are precision ground. The CLAUSING reduces setup and operating costs. It's low in initial investment, low in upkeep costs. See it at the ASTE Exposition!

SEE YOU AT THE ASTE EXPOSITION
INTERNATIONAL AMPHITHEATRE
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BOOTH 1418 **MARCH 19-23**

Atlas Press Company
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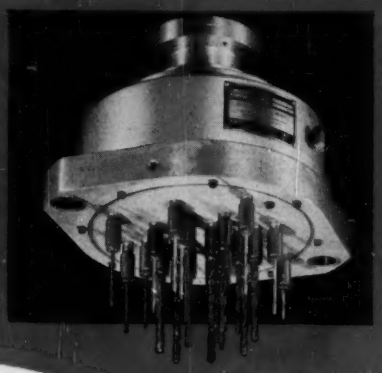
MAKE ZAGAR your HOLE CENTER

FOR DRILLING, REAMING AND TAPPING . . . . . .



Any hole pattern—on any center up to 1⅞" dia.

Zagar's Broad-Scope *Engineering* SOLVES ANY HOLE PROBLEM

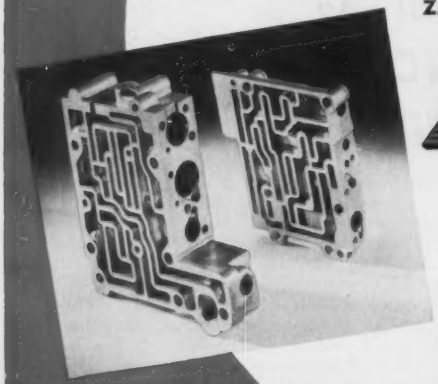
Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

ZAGAR TOOL, INC., 23890 Lakeland Blvd., Cleveland 23, Ohio

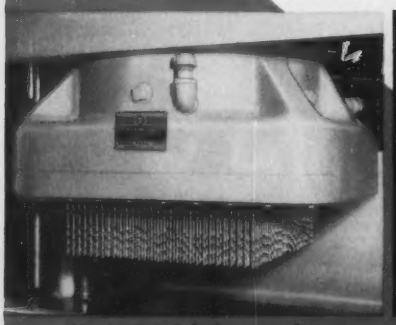
Zagar

TOOLS FOR INDUSTRY and SPECIAL MACHINERY

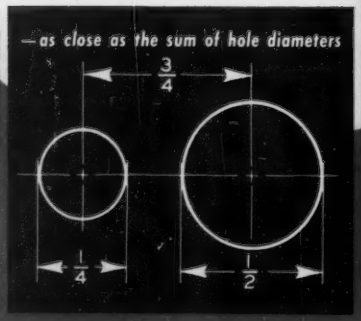
We're at the A.S.T.E. Show—Booth 179.

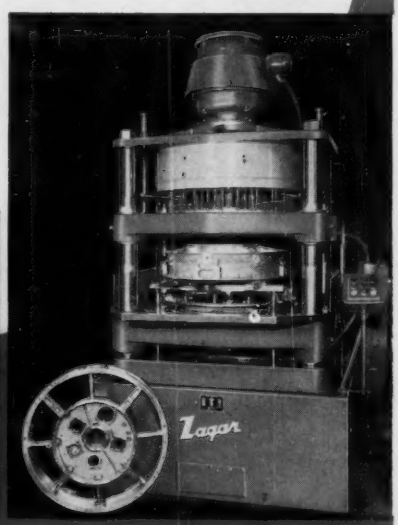


Any machinable material—from all angles.



Up to 1000 holes can be drilled IN ONE PASS.





4-post ram-type drilling machine for aircraft parts.

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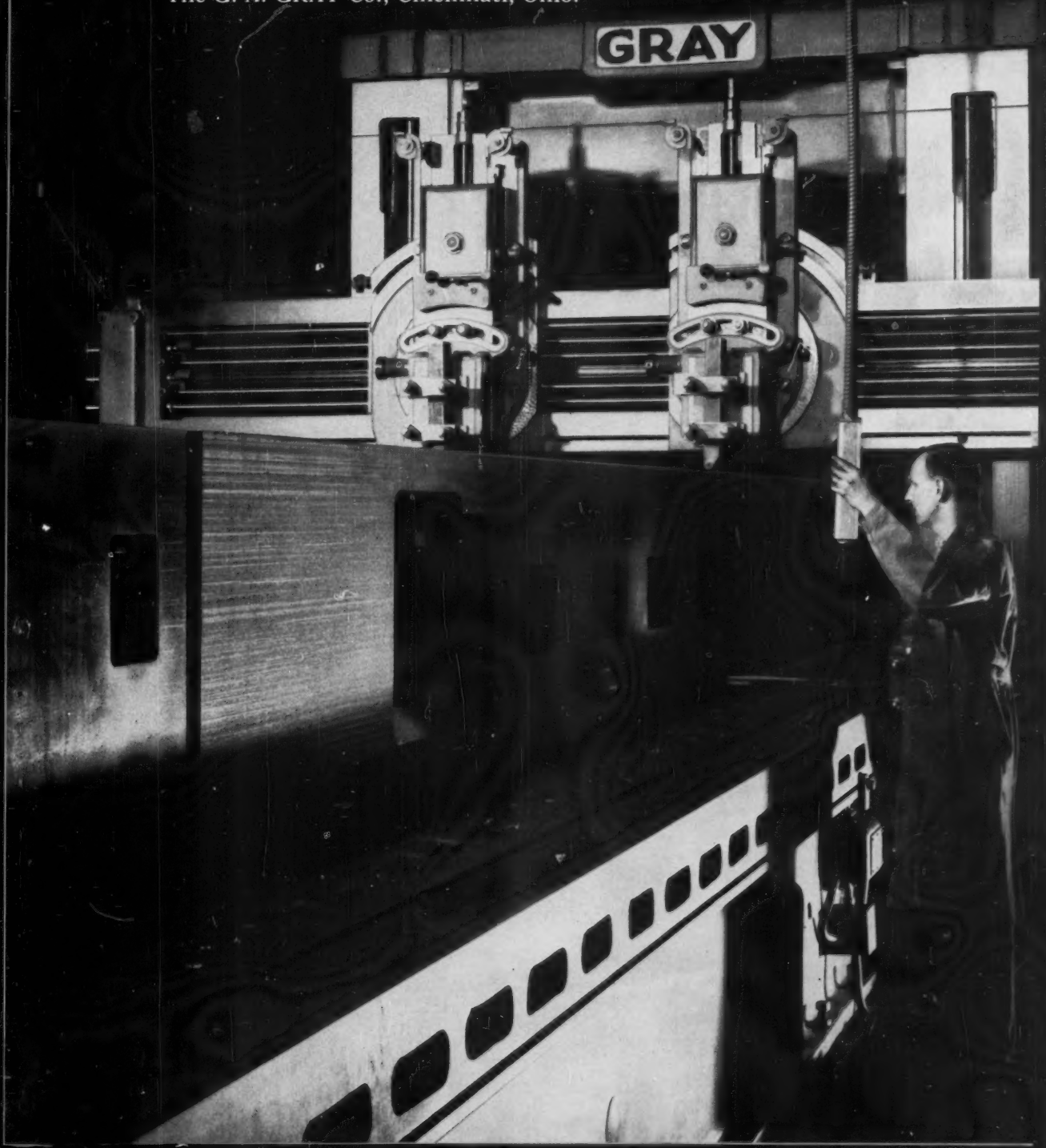
Magnificent monster

The GRAY is recognized by machine shops throughout the world as the ultimate in planers. Built for high production with great precision, it combines more original engineering developments and production features than any other planer. It is in such demand that GRAY is the largest planer builder, further proof that

Quality doesn't cost . . . it pays.

The G. A. GRAY Co., Cincinnati, Ohio.



GISHOLT

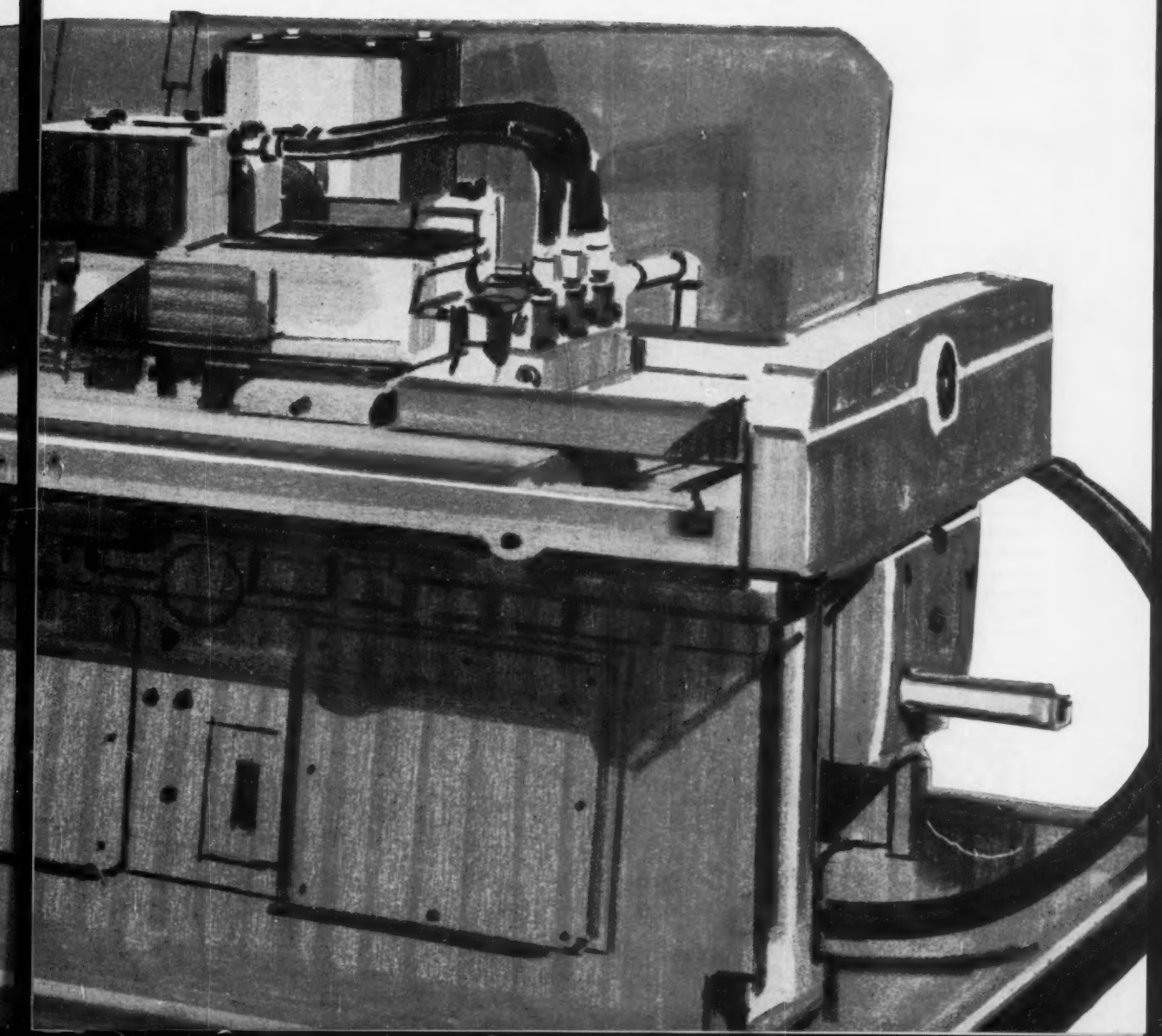
GISHOLT MASTERLINE SIMPLIMATIC AUTOMATIC LATHE

MASTERLINE GISHOLT SINCE 1887

This is the latest design of the Gisholt MASTERLINE Simplimatic. There are many important improvements and outstanding features. Operation is faster. Setup and change-over are quicker. Maintenance is lower. In short, here is an advanced design for better work at lower cost—and with new minimum requirements for operator skill, attention and effort. Let us tell you more about these improved machines —and how they may be applied profitably to your manufacturing processes.

Gisholt Machine Company, Madison 10, Wisconsin

Look ahead—keep ahead—with Gisholt



the finest high production lathes

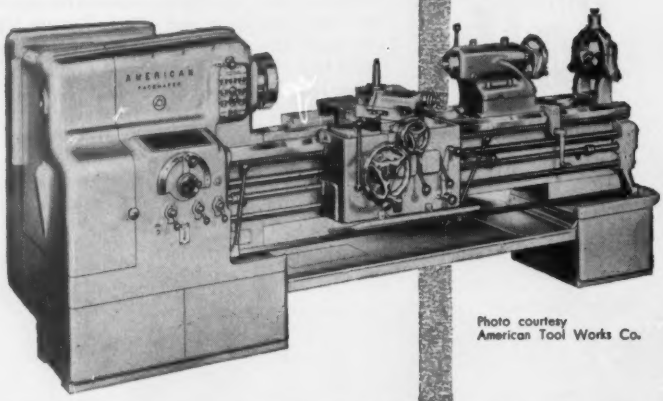
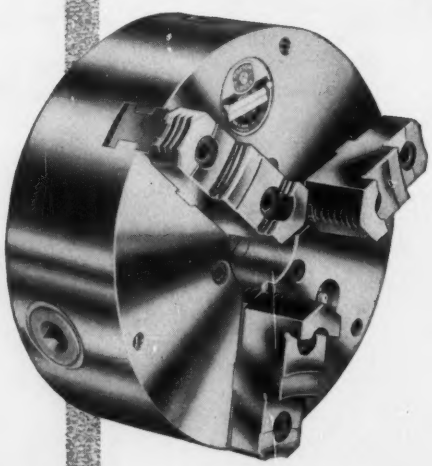


Photo courtesy
American Tool Works Co.

Here is the new 16" DeLuxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

deserve the finest high production chucks

This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.



HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.

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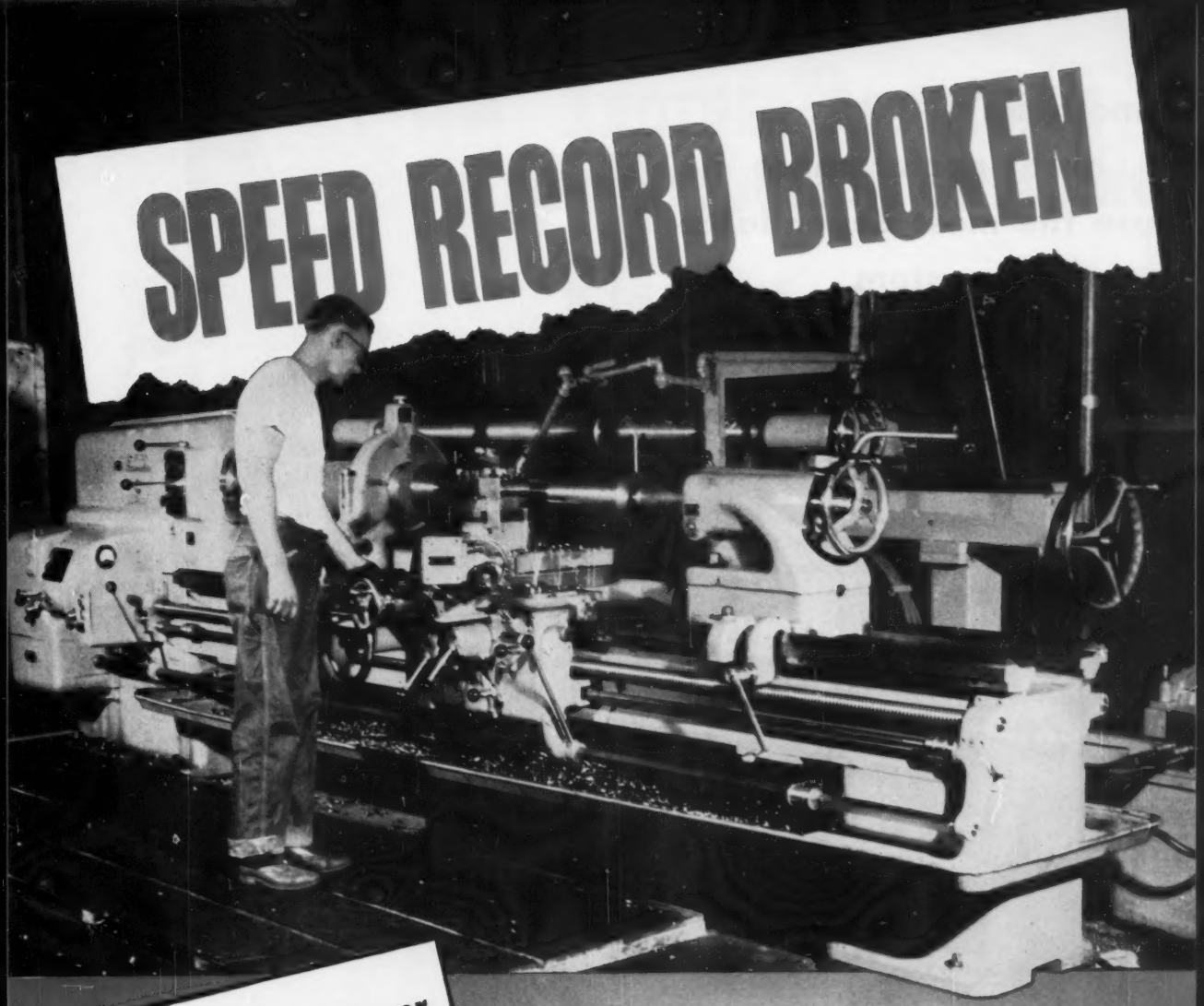
SPEED RECORD BROKEN



2,000 Horse Power Motor Shafts

ROUGH and FINISHED in

2¼ hrs.

Former Time 9 hours

Fairbanks, Morse & Co., Beloit, Wisconsin, is getting this amazing production day after day on its *20 inch "AMERICAN" All-hydraulic Duplicating Lathe.*

These shafts are made from 7½" diameter by 84" long hot rolled stock weighing 1059 pounds. A 30 horse power roughing cut and 15 to 20 horse power finishing cut completes the operation.

Note particularly that a finish turned motor shaft is used for a template, showing the rugged stability of "AMERICAN" Template Supports.

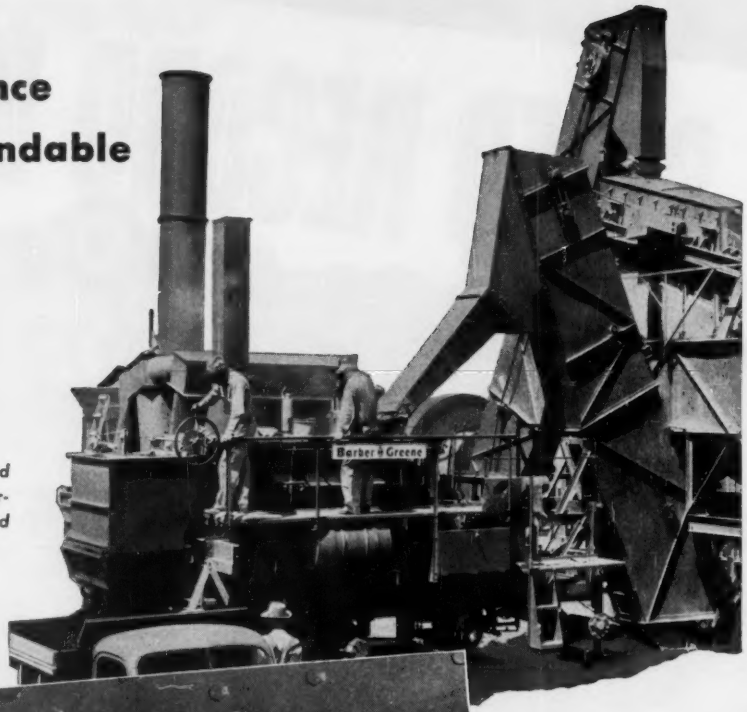
The quality of Fairbanks-Morse's products are universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to them. "AMERICAN" Hydraulic Duplicating Lathes hold many production records for work of this nature. Let us show you what they will do on your work.

Send for Bulletin No. 35.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

kipp

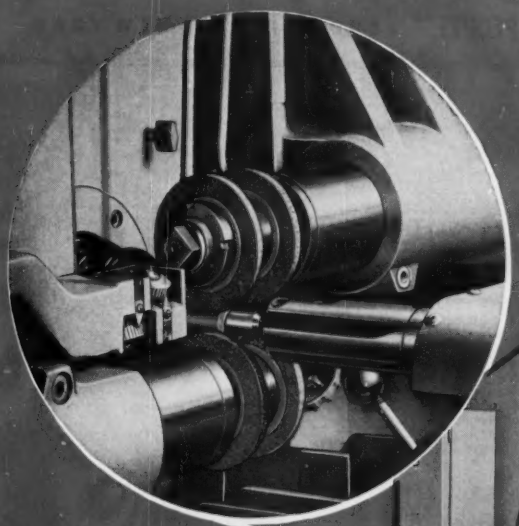
MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

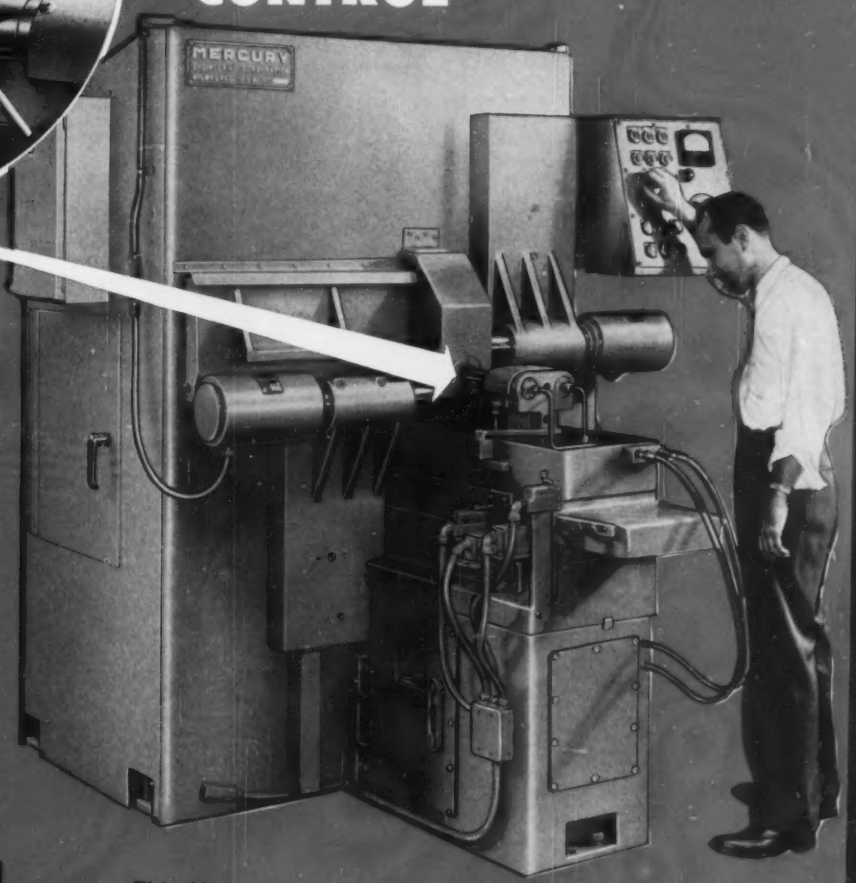
• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information fill in page number on Inquiry Card, on page 255

Introducing... ANOTHER APPROACH TO PRODUCTION GRINDING

Featuring... AUTOMATIC QUALITY CONTROL





- Four surfaces precision ground simultaneously
- Automatic diamond dressing establishes size every cycle
- Automatic fixture guarantees "3D" stability
- Mercury's rugged simplicity assures sustained performance

A SYMBOL OF FINE CRAFTSMANSHIP SINCE 1933

This Mercury precision grinder finishes the four sides of two opposed keys on an automotive steering gear component at the rate of fifty pieces per hour. The part is rough ground and finish ground to size without manual handling or gaging.

MERCURY — *Designers and Builders of Special Grinding Machines*

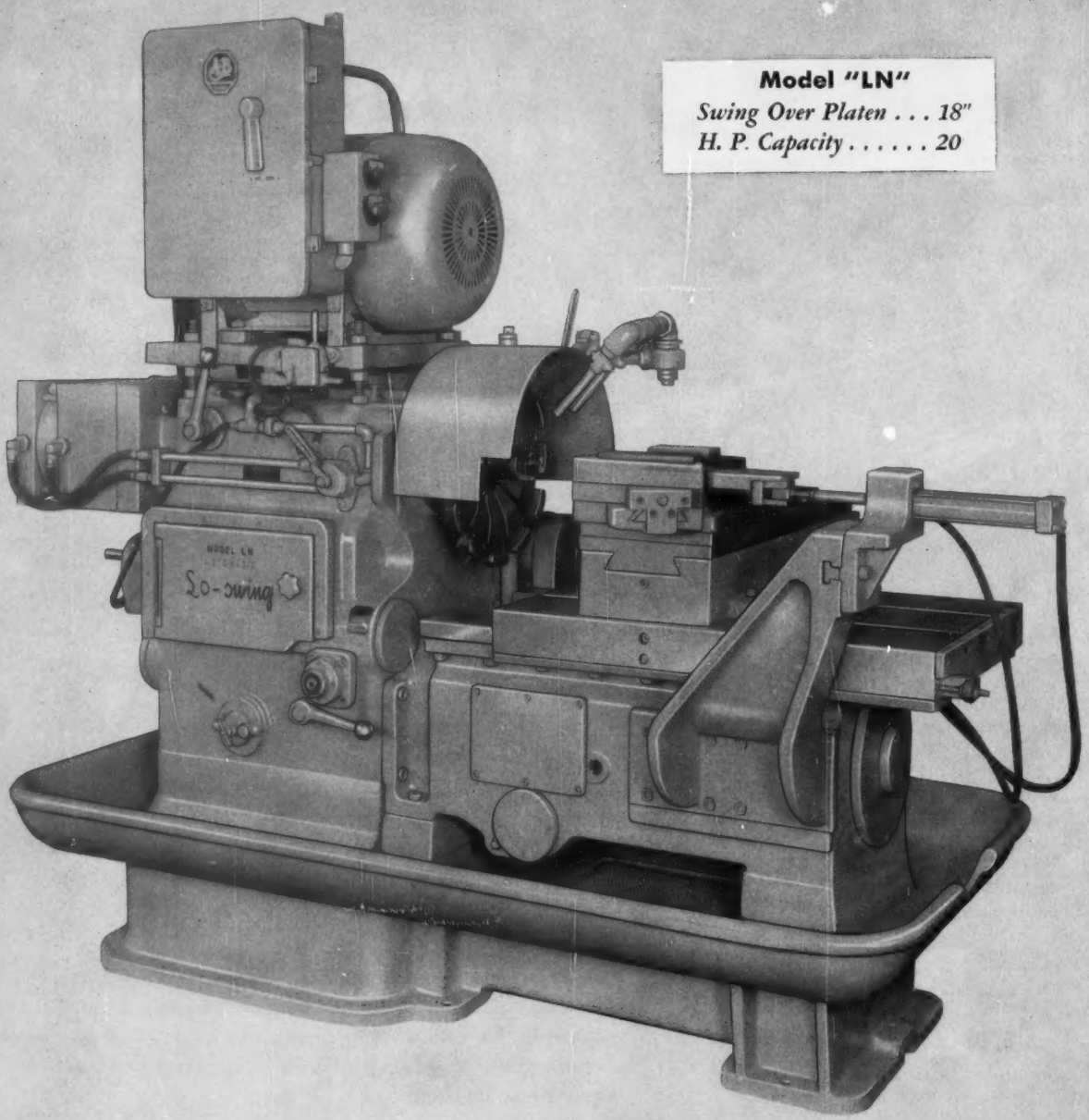
MERCURY ENGINEERING CORPORATION

Milwaukee 2, Wisconsin

Your Inquiry Is Invited

MACHINE OF

PREPARED BY THE SENECA FALLS MACHINE CO. "THE So-swing PEOPLE" SENECA FALLS, NEW YORK



Model "LN"
Swing Over Platen . . . 18"
H. P. Capacity 20

SENECA FALLS PLATEN-TYPE,

THE MONTH

NEW PLATEN-TYPE AUTOMATIC LATHES CUT BORING, FACING AND TURNING COSTS

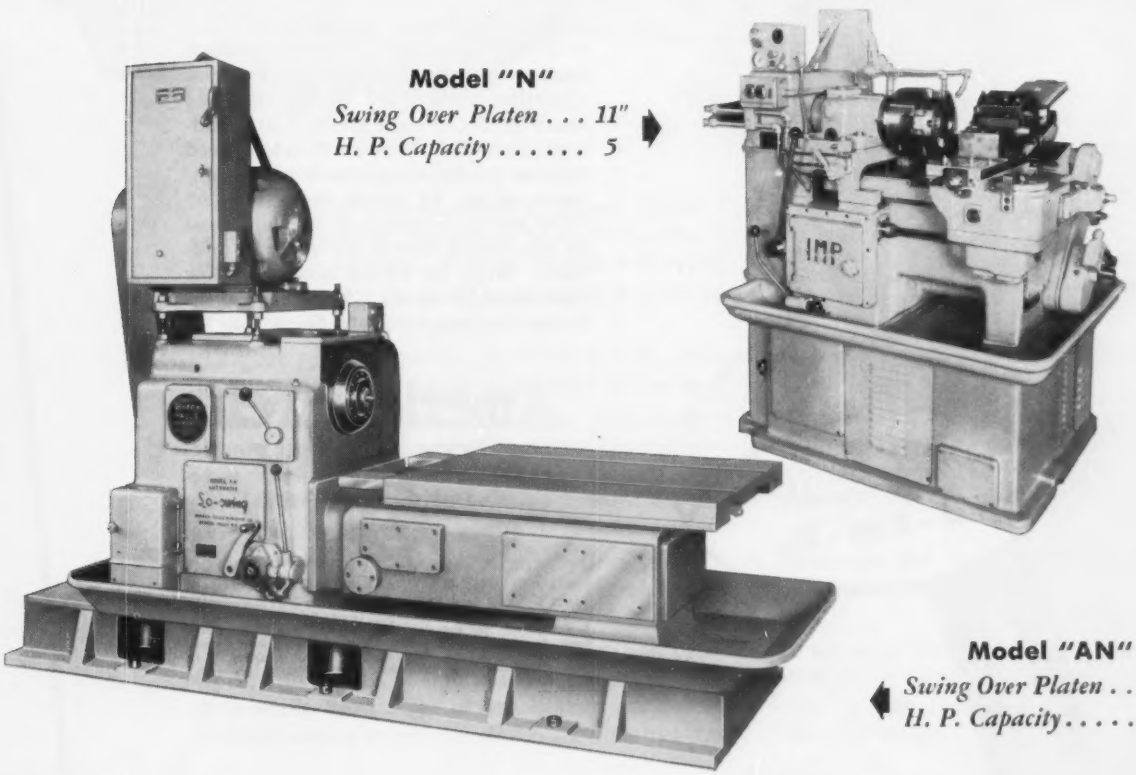
The NEW Seneca Falls Platen-Type Automatic Lathes have been designed principally as chucking machines adaptable to a wide variety of work requiring large swing capacity, high spindle speeds, multiple tooling and fast cycling operation.

The platens have cam operated longitudinal and cross feeds and may be equipped with angular feeding slides and other special attachments suitable for customer's work.

All three types of machines may be equipped with Seneca Falls Automatic Loading and Transfer Equipment which provides means to extend automaticity to individual machines or through a series of successive, though dissimilar, operations to combine work loading, machining and work transfer into one single, automatically controlled phase of production flow.

Seneca Falls production-minded engineers are at your disposal to solve your chucking problems.

Write for Bulletin N-B



Model "N"
Swing Over Platen . . . 11"
H. P. Capacity 5

Model "AN"
Swing Over Platen . . . 24"
H. P. Capacity 40

CAM-OPERATED AUTOMATIC LATHES

This FELT can CONTROL that Vibration!

When machinery has the shakes, put it on Vibra-Mount* Felt. This resilient cushion greatly reduces the amount of vibration transmitted to the floor, as much as 85%. People are happier, buildings safer. Vibra-Mount Felt is long lived because it takes compression with a minimum of set. In almost every case lag bolts are unnecessary, so machines can be rearranged with a minimum of difficulty. Write for FREE booklet, "How to Reduce Vibration." For technical information, ask for Data Sheet No. 10.

*T. M. Reg.

American Felt Company

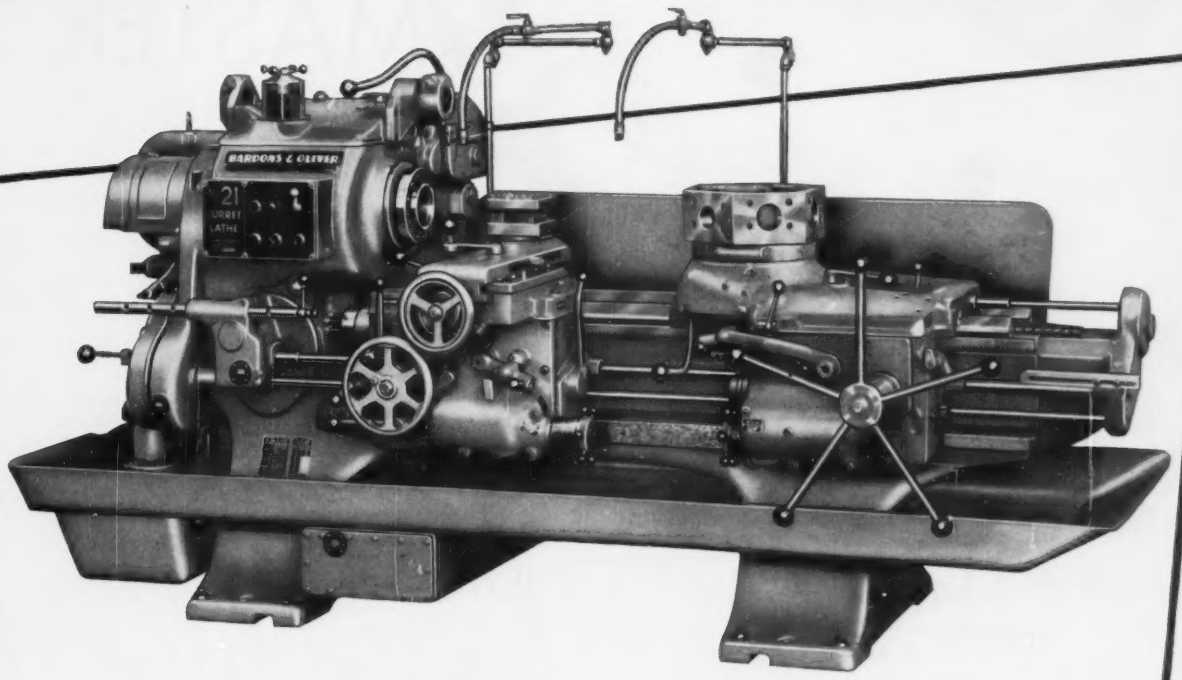
TRADE MARK ®

GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.
SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Greenville, S. C., Dallas, San Francisco, Los Angeles, San Diego, Portland, Seattle, Montreal.—PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I. —ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

For more information fill in page number on Inquiry Card, on page 255

NEW BARDONS & OLIVER No. 21

. . . a Completely Redesigned Saddle Type Turret Lathe



This smaller size Bardons & Oliver Saddle Type Turret Lathe has been redesigned to provide maximum versatility. The new No. 21 will accommodate a wider range of work, both as to size and type.

A larger main drive motor of 20 H.P. permits heavier feeds to the full capacity of the latest in cutting tools.

Higher spindle speeds, to 1000 R.P.M., adequately provide for work of non-ferrous materials as well as smaller diameters.

While the rigid bridge type cross slide carriage is still optional, a choice is now offered of a full swing side carriage. The full swing carriage offers the advantages of increasing swing over the cross slide, additional clearance for the hexagon turret tooling, and rapid traverse to the cross slide. These features are particularly desirable for the larger range of chucking work.

A completely self-contained hydraulic bar feed decreases the feed out time by one-half. The new hydraulic collet chuck has amply increased gripping force for the heavier drilling operations.

The No. 21 B size machine has 3" round collet chuck capacity for standard duty work. The No. 21 C size machine has 4½" round collet chuck capacity, for light duty work. Both sizes of machines provide either 15½" swing over cross slide with full swing carriage, or 12½" swing over cross slide with bridge type carriage.

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

ANNOUNCING the CHECK MASTER

ACTUAL SIZE

PATENT PENDING

AN ALL NEW TEST INDICATOR

by STANDARD

SEE IT AT BOOTH 1016
AT THE ASTE EXPOSITION

1. Light contact pressure (15 grams standard), uniform for both directions of contact point.
2. Contact positions over full 180 degree arc. Points interchangeable.
3. Clockwise movement of hand for both directions of contact point. Directional reverse-lever eliminated.
4. Indicator graduated to .0001″, range .008″—unusually sensitive, responding to dimensional variations of .000020″.
5. Exceptionally versatile mounting holder.

WRITE FOR DESCRIPTIVE BULLETIN

STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

92 PARKER AVE. POUGHKEEPSIE, N. Y.

STANDARD Gages

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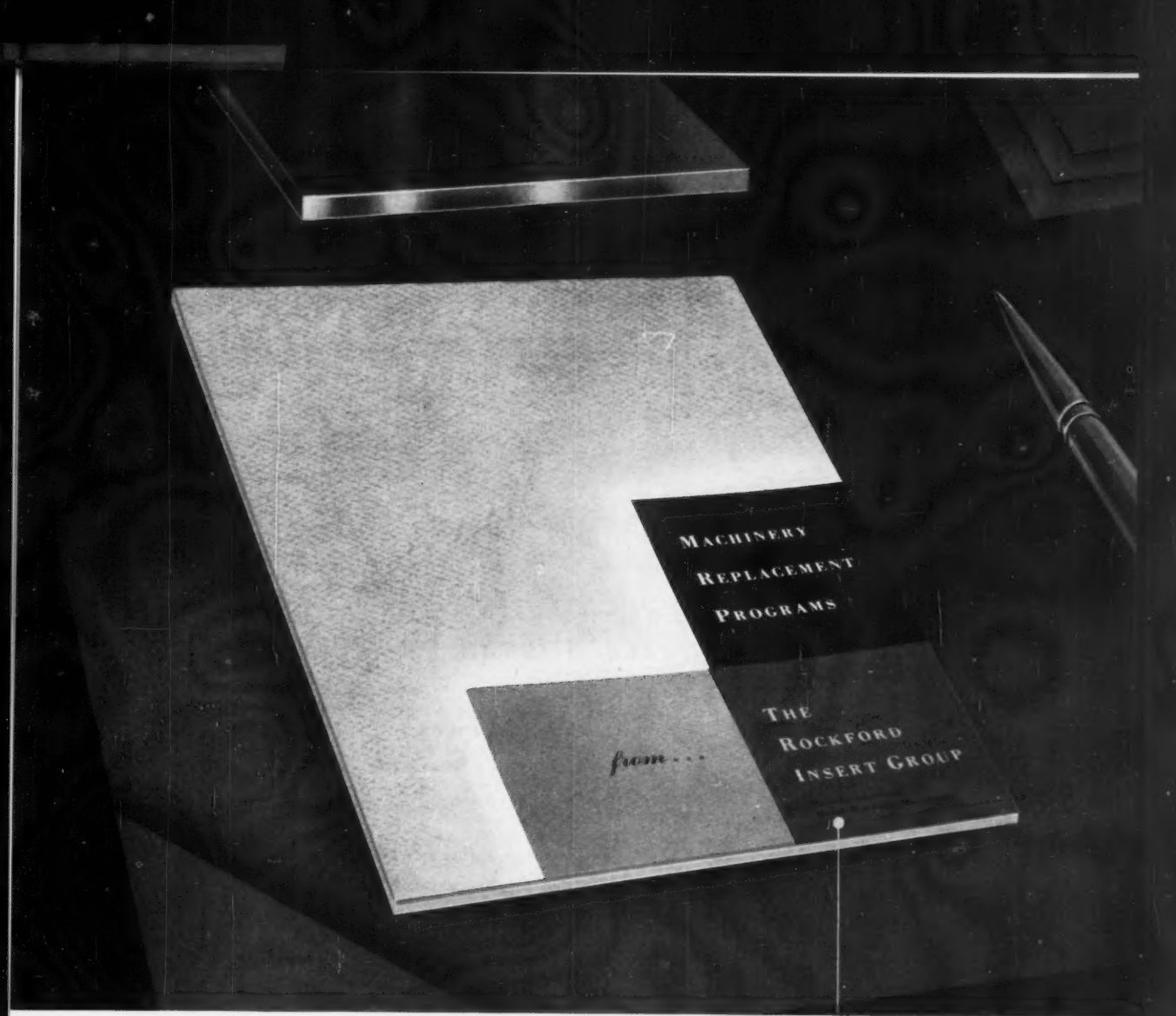

If you have a *finger* in Machinery and Equipment buying you should have this book

Fifteen prominent industrialists discuss their machinery and replacement programs in this book. This valuable information represents the most up-to-date collection of evidence of the importance of such programs in industry today. For your free copy merely write to any one of the companies in the Rockford insert group.

Keep gathering metal working production ideas . . . be well informed when you replace machinery . . . . . .

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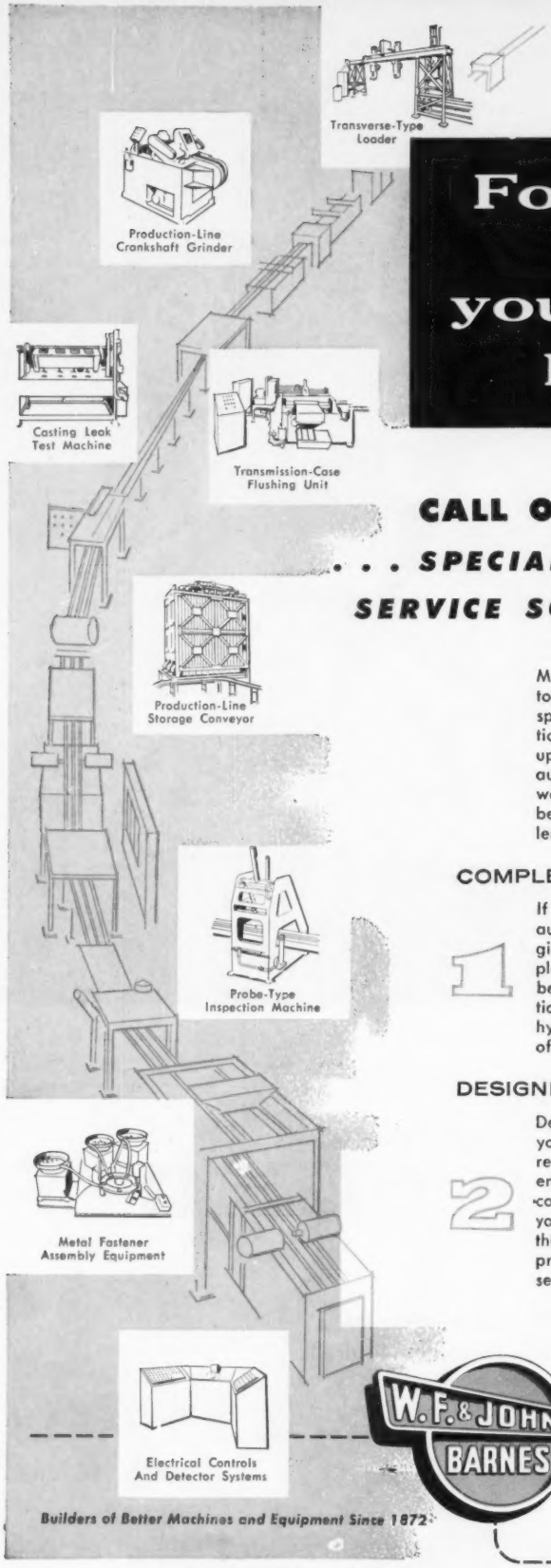
March, 1956



For a practical solution to your automation problems....

CALL ON W. F. & JOHN BARNES

. . . SPECIAL TWO-FOLD COORDINATED SERVICE SOLVES PROBLEMS QUICKLY

More and more production executives than ever before are today turning to Barnes for help in designing and building specialized automation equipment. With 80 years of practical machine building experience, Barnes have been called upon to design and build hundreds of different types of automatic handling and special processing equipment as well as special high production machine tools. Now, to better serve demands and help you solve automation problems quickly, Barnes offers a two-fold coordinated service:

COMPLETE PRODUCTION-LINE ENGINEERING

1

If you are planning new production-line methods for either automatic or semi-automatic operations, an experienced engineering staff is available to work with you. The detailed plans and proposals submitted for your consideration can be depended upon to provide you with the latest in automation engineering and the very best of proven mechanical, hydraulic, and electrical actuation. Ask for a free survey of your problems early in your planning program.

DESIGNING & BUILDING SPECIALIZED UNITS

2

Designing and building specialized, individual units to suit your specific needs is a separate, additional service. Where required, electrical, mechanical, hydraulic, fixture, and tool engineers work together as a team. All efforts are closely coordinated with complete manufacturing facilities to save you time and eliminate divided responsibility. As illustrated, this service covers hundreds of different types of automatic processing and work-handling units that are today profitably serving a wide range of industrial needs.

ANALYSIS OF METHODS — Call on Barnes engineers today for a practical solution to your automation problems. Or, ask for an analysis without obligation.

W. F. & JOHN BARNES

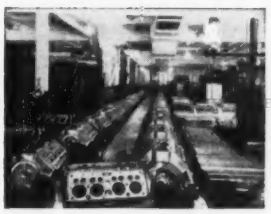
Builders of Better Machines and Equipment Since 1872

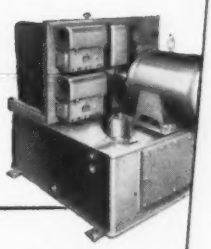
AUTOMATION SECTION

415 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

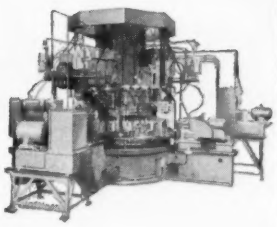
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



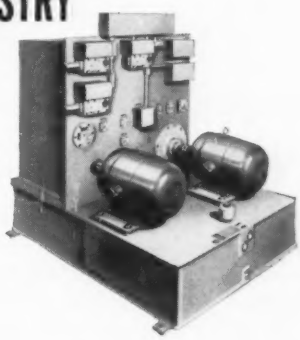


Memo From
John S. Barnes Corporation

Here is the story of a new concept in hydraulic power transmission and control. Maintenance is simplified to cut costs substantially. Send for your copy today!

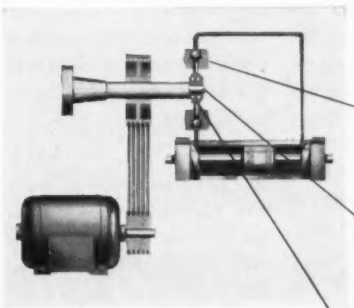


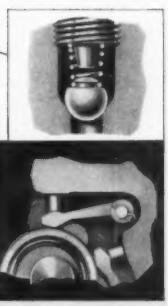
BARNES hydraulics in mass production INDUSTRY



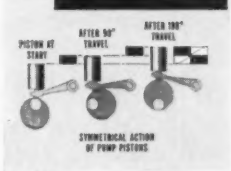
alone

BARNES closed fluid circuit and drive





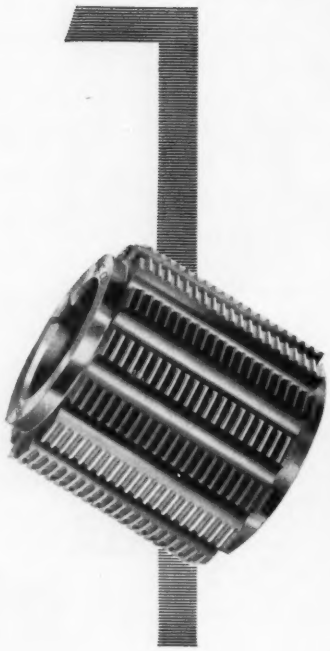
The Barnes Closed Fluid Circuit consists of a rotary supporting means; a variable displacement pumping arrangement synchronously driven from the rotary means; and a driving arrangement, including means for connecting and disconnecting the rotation of the rotary means, which causes the displacement pump to operate automatically and synchronously with the rotary supporting means.

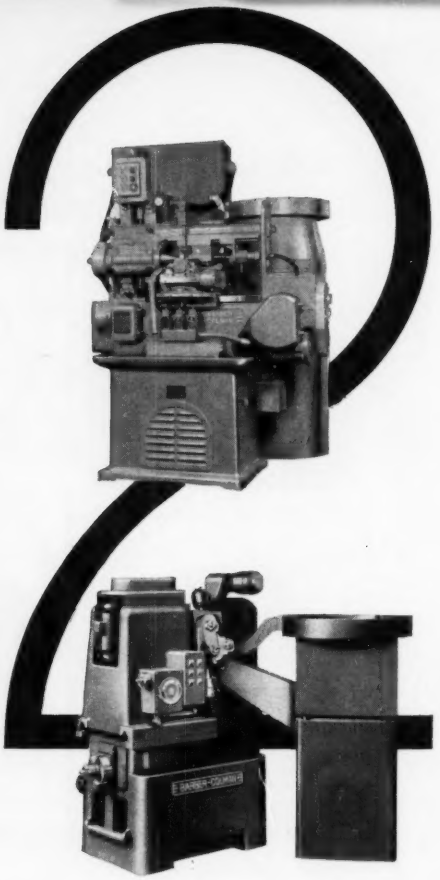


JOHN S. BARNES CORPORATION / ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS ROCKFORD, ILLINOIS, U.S.A.

it takes top equipment to cut the best gears





BARBER-COLMAN offers

Superior Hob Accuracy

As a result of long experience and skill in hob manufacture, Barber-Colman offers a new concept of ultra-precision in hob tolerances. An example is a 48 DP Class AA hob, ground to total allowable lead variation of .00015" tooth-to-tooth, .00015" in any one axial pitch, and .0003" in three axial pitches. Tolerances such as these are only practical where machine and hob sharpening have equally close tolerances. We suggest you contact our engineers for recommendations when you have jobs requiring hobs of this accuracy.

For production hobbing, Barber-Colman makes Class A, Class B and Class C hobs. Classes A and B are ground on the form and are recommended for accurate finishing and semi-finishing. Class C Accurate Unground hobs are used primarily on preshaved gears. All hobs are well within the standard tolerances for their particular class and pitch.

Automated Gear Production

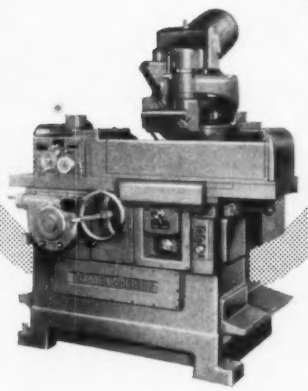
For high speed, mass-production gear problems, Barber-Colman engineers have developed fully automatic hobbing machines, including magazine or hopper-feed loading, fully automatic cycle and automatic hob shifting.

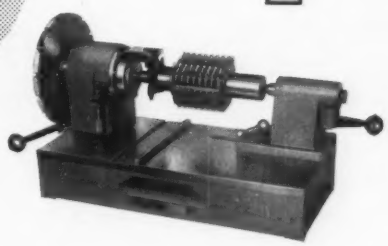
For maximum production of specific parts, machines are designed with special purpose tooling, loading, gaging and handling to suit the requirements for accuracy and finish. Such machines may also include inspection, rejection, and size-gaging as part of the automatic cycle.

General purpose hobbing machines are available for hobbing parts up to 16" diameter, from 3½ DP to the finest pitches. A variety of special tooling can be furnished — hydraulic, pneumatic, electric — to give maximum accuracy and production efficiency for the particular problem.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

345





Controlled Hob Sharpening

The inherent accuracy in Barber-Colman hobs and hobbing machines may be upset if all factors are not in adjustment. A common cause for loss of accuracy is error in resharpening hobs. To provide positive sharpening control on a production basis, and to insure maximum accuracy in sharpening, Barber-Colman engineers have developed a series of automatic sharpening machines. With these machines the sharpening operation becomes simple, fast and convenient, and original tool accuracy is easy to maintain.

Hob Sharpening Inspection

The Barber-Colman Hob Sharpening Checker is a precision instrument for measuring the accuracy of face sharpening on straight and helical fluted hobs. The precision found in Barber-Colman hobs is inherent and the only place it can be lost is in the sharpening operation. Reasonable in cost, this checker furnishes a convenient method for checking the sharpening accuracy.

Gear Cutting Service

Barber-Colman hobbing engineers, backed by years of experience in the field, and special skills acquired in production hobbing of gears, are available without cost to analyze and make recommendations on gear problems. This service will help to maintain peak efficiency in your gear cutting operations. Send us inquiries about accuracy, tooling, production and special toothforms.

BARBER-COLMAN COMPANY

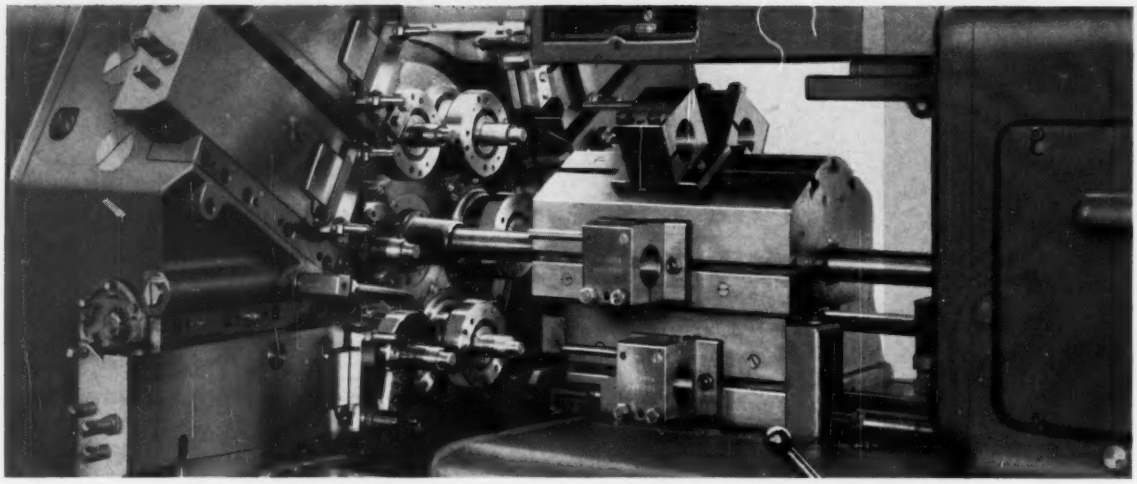
621 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

WIDE-OPEN TOOLING AREA



one of the many advantages you'll find in Greenlee

BAR AUTOMATICS

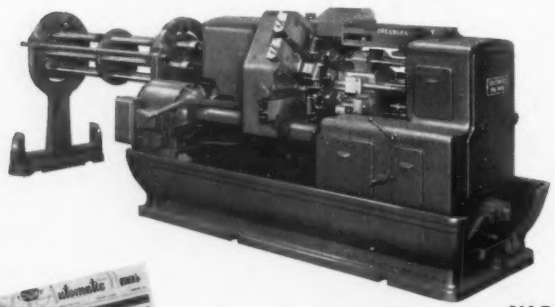
PRODUCTION MACHINERY

GREENLEE

FIRST WITH MANAGEMENT . . . FIRST WITH OPERATORS

This wide-open tooling area has made many friends for Greenlee in the shop and in the front office. Easy, fast tool changes and adjustments save time . . . reduce costs. The operator experiences less fatigue . . . works with greater safety . . . an important advantage in any shop.

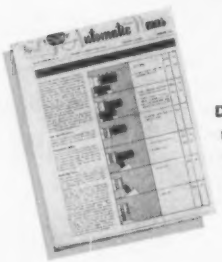
The center of the symmetrical tooling area is only two feet from the outside of the machine. Easy tool arrangement is invited by seven full-length T-slots in the way-type main toolslide. Holders are easily applied . . . can be mounted one behind the other. Cross-slide tooling is interchangeable . . . easily adjusted to work in any spindle position. Built-in coolant system is totally enclosed. Flow adjustable at each nozzle.



4-SPINDLE . . . 6-SPINDLE SECOND-OPERATION PNEUMATIC STOCK FEED

Greenlee Automatics now offer greater accuracy . . . faster production. Spindle construction has been improved . . . precision and spindle speeds have been increased. Find out how these machines can save you time and money. Investigate now!

WRITE TODAY FOR CATALOG A-405



Do you receive a copy of the Greenlee "Automatic News" regularly? If not, ask to be placed on our mailing list today.

PRODUCTION MACHINERY

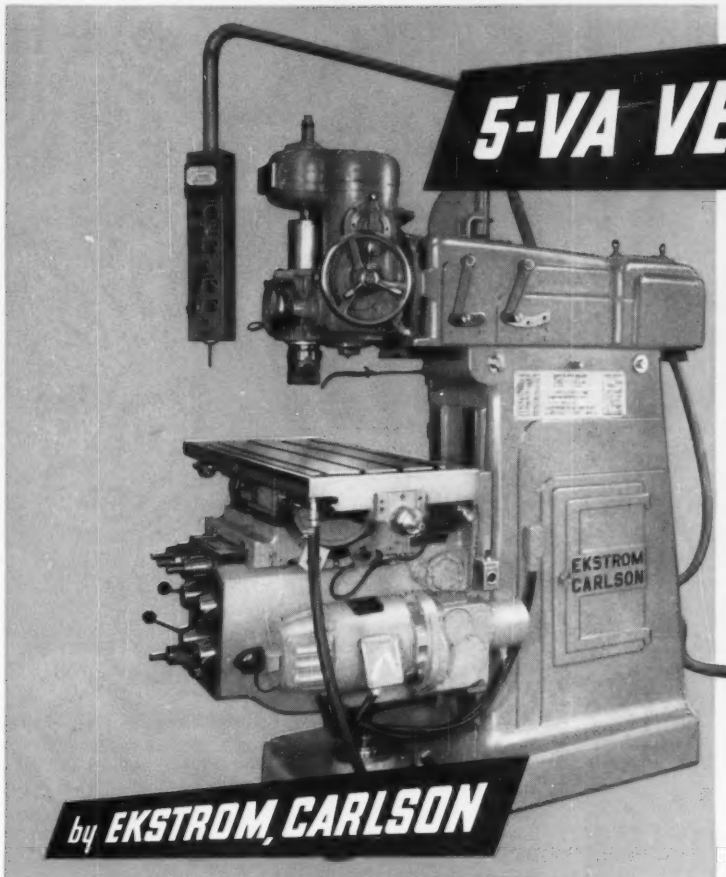
GREENLEE

GREENLEE BROS. & CO.
1864 Mason Avenue
Rockford, Illinois

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

5-VA VERTIMIL

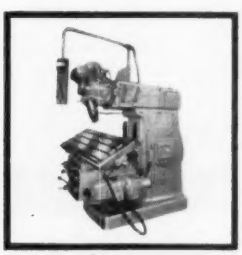
A GREAT MACHINE MADE EVEN GREATER



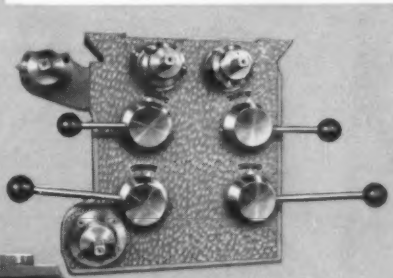
by EKSTROM, CARLSON

Electronic INFINITELY-VARIABLE FEEDS INCREASE VERSATILITY TREMENDOUSLY

Here is a really *outstanding* Vertical-Spindle Milling Machine — for toolroom, job shop, and production use. Newest improvements include electronic controls that give continuously-variable feed ranges of .250″ to 100″ per minute on longitudinal and cross travel of the table, and from .070″ to 38″ per minute on vertical travel of the knee; both in two simple stages. A new pendant, convenient to the operator, carries all the control buttons, and the feed-setting arrangements and indicator. New gear-control levers on the knee improve the convenience and efficiency of set-up and operation. All in all, this great machine is *hard to beat* by the most up-to-date of modern standards. Let us tell you more about it . . . *write for full information.*



Left, picture shows extreme positions. Table tilts 30° either forward or back, spindle swings 45° to either side.



Above, manual and power table and knee directional controls are now all concentrated on the front of the knee to save the operator a lot of reaching around.

Left, the control pendant has a feed-rate indicating meter at the top, a master stop stick at the bottom, and all vital operating control buttons and selection switches on the panel.

12 SPINDLE SPEED RANGES FROM 72 TO 2480 RPM

EKSTROM, CARLSON & CO.

1400 RAILROAD AVE., DEPT. M-4, ROCKFORD, ILLINOIS

Manufacturers of Machinery and Tools Since 1904

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

How Sundstrand "Engineered Production" Has Been Applied To:

Production requirements dictate the proper design and tooling for all machine tools. If the required production is low and many similar parts are to be produced on the same machine, the most economical type of tooling and equipment is one that can be readily adjusted so that there will be a minimum of down time for change over. If the required production is high, the reverse is true, since the problem then is primarily one of tool maintenance coupled with automatic handling of work parts.

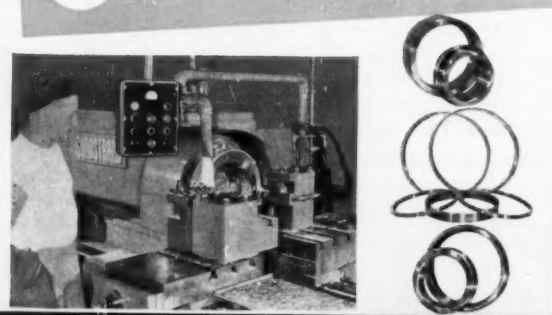
Sundstrand engineers have accumulated a vast knowledge of tooling from handling a wide variety of jobs. Here are just a few examples of Sundstrand "Engineered Production" as applied to turning problems.

1 High Production Turning

The lathe above is a good illustration of a high production setup. Motor rotors are turned and faced at a production rate of over 200 pieces per hour. The machine is automatically loaded and unloaded, parts and tools are gaged for wear. Machine runs approximately an 8 hour shift, re-setting the tools automatically before a normal replacement of the tool head is necessary.

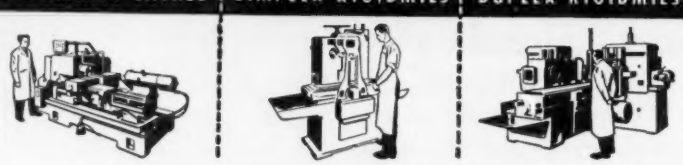
Pistons, cam shafts, crankshafts, etc. lend themselves to many of the features incorporated in this machine. If you have parts of this nature produced in large quantities, see what Sundstrand "Engineered Production" service can develop for you.

2 Small Lot Turning



AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

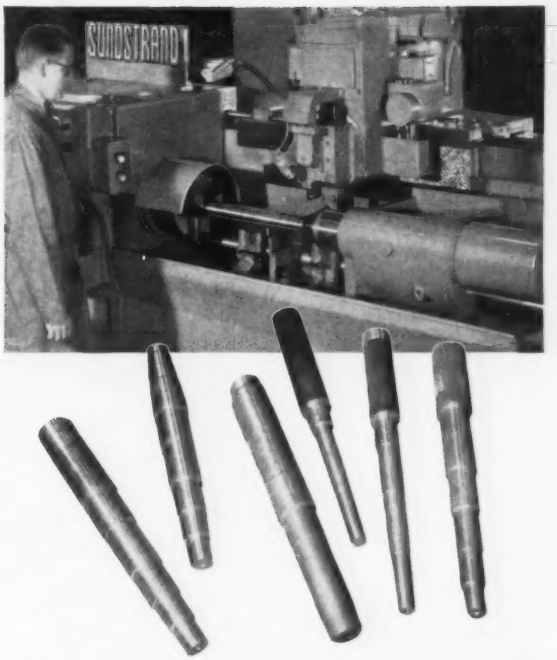
SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

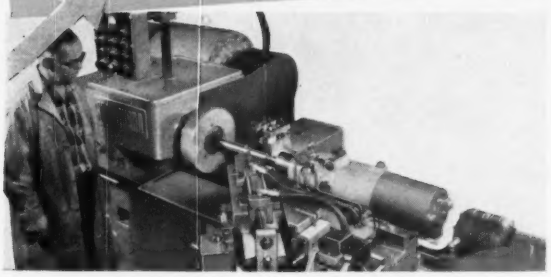
In the illustration at the left below, more simple tooling, easily adjusted, has been provided to handle a number of different sizes of similar parts. Tool adjustments are easy because of the simplicity of the tooling, and the quick set cycle control of the Sundstrand Automatic Lathe makes it profitable to use multiple tooling on jobs of this nature.

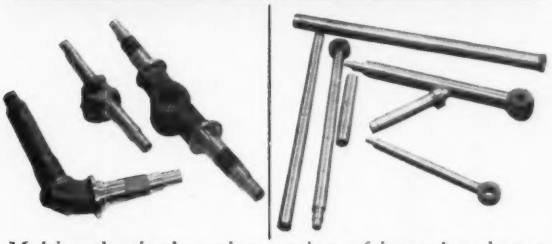
4 Shaft Turning



This machine is offered with punch card control or manual operation. With punch card control, it brings production control to the engineering department. Again, it is a design solution to turning of shafts, but talk to Sundstrand Engineers and investigate Sundstrand "Engineered Production" for the proper solution to your job.

3 Tracer Turning



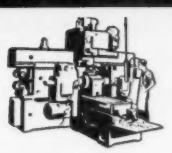


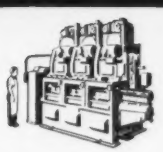
Multi-cycle single point turning of irregular shapes can be obtained quickly and easily with new Sundstrand Automatic Lathes equipped with this tracer control. The lathes are provided with a template controlled tracing unit, which replaces the regular front carriage. Ruff, semi-finish and finish cuts can be made with one turning tool in one automatic cycle.

Before You Buy Any Turning Equipment Check with Sundstrand *"Engineered Production"*

These are only a few of many applications of Sundstrand "Engineered Production" as applied to turning problems. Your job may be entirely different, but we invite you to investigate. Call in a Sundstrand engineer. There is no obligation for this service.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

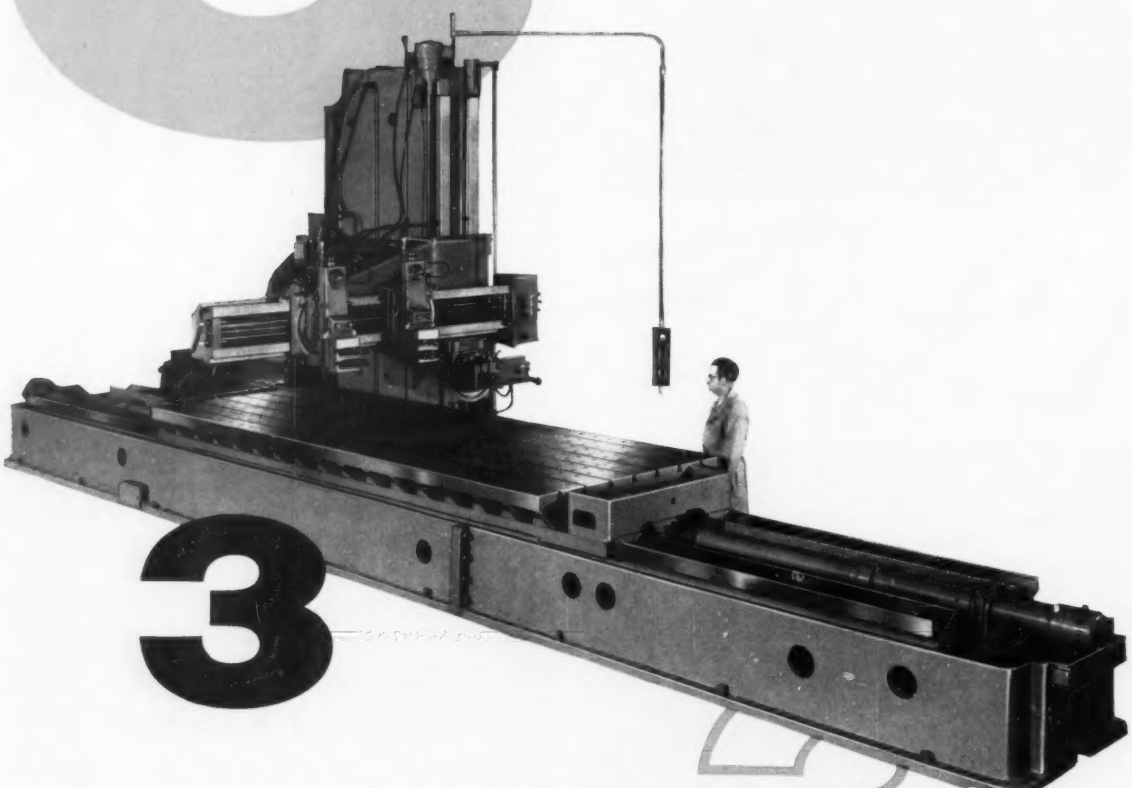




SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

3 planers in one machine



Pendant control of range and cutting speed selection.

Maximum return speed regardless of cutting speed.

Quick reversals with minimum overtravel.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

with hydraulic triple circuit

h3 drive

low speeds to 100 fpm. with force for heavy cuts
medium speeds to 150 fpm. with force for normal cuts
high speeds to 300 fpm. with force for light cuts

H3 drive is an exclusive new feature on Rockford Hydraulic Planers. In the three speed circuit, a double acting cylinder opposed by a single acting cylinder are employed, giving three speed ranges with the power inversely proportional. The hydraulic triple circuit provides the correct speed and force—in one machine—to most economically machine every type of metal. Ask a Rockford Machine Tool Co. representative for further information, or write direct.

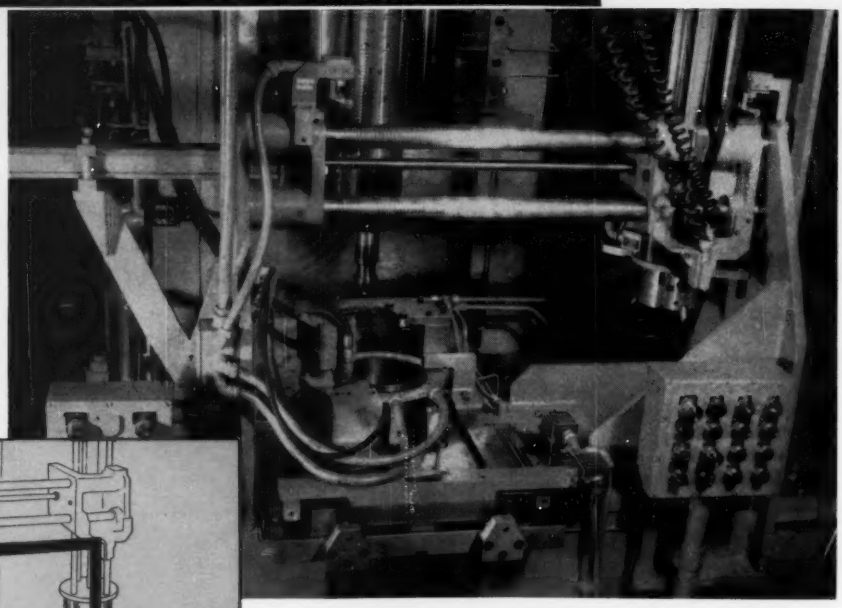
ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

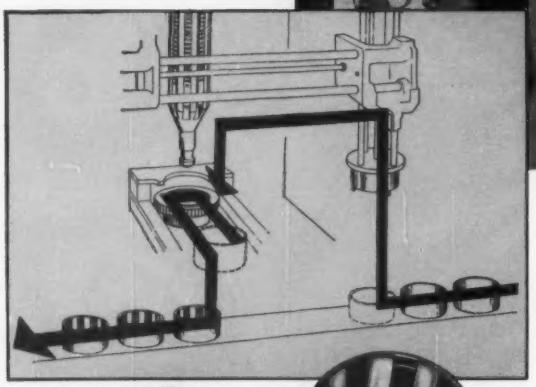
h3 drive

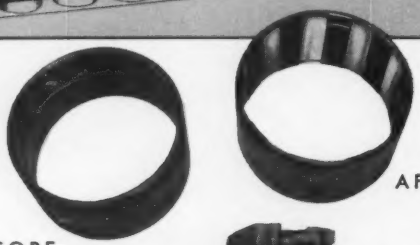
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

more about **AUTOMATION** by *American* ...

Brake Drums
SPLINE BROACHED
with Automatic Transfer from and to Conveyor

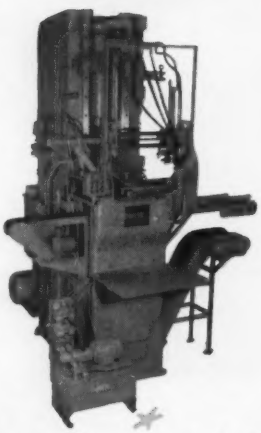






BEFORE AFTER

American 30 ton—60" stroke pull down broaching machine with full follow-up broach retriever, continuous belt conveyor and automatic chip conveyor.



American engineering solved this automation problem with a hydraulically operated loading mechanism, with an internal chucking device, that picks up the brake drums from a conveyor and inserts them in a collet-type work-holding fixture. The fixture automatically clamps the part and moves it into broaching position. The broach is then pulled down through, broaching 10 splines in the cast iron part. As the fixture slides back to loading position, the part is automatically ejected to the same conveyor line from which it was picked up.

Economical tooling is another feature of the machine. As shown in the simplified cross section at right, an arbor mounts ten sectional surface broach assemblies, which can be easily removed for sharpening and replacement.

American approaches each broaching problem as part of the complete production cycle. Methods of parts handling can frequently be suggested that will give you efficient and stable production. Write or 'phone today — American will be glad to work with you.

ASK FOR CATALOG 450. It's a complete broaching manual.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Rehnberg-Jacobson

BRIDGE-TYPE DESIGN OFFERS ADVANTAGES

On a machine of this kind, the powered units are supported on a very strong and rigid bridge-like structure over the index table. In comparison with a center-column arrangement, the bridge permits use of a less-costly standard index unit and provides greater overall stiffness for accurate work. In comparison with a single-column arrangement, the bridge permits use of a variety of separate units in place of all spindles in one unit. The use of separate units, which can be positioned almost anywhere required, provides extreme versatility of arrangement — and easy re-arrangement to accommodate engineering changes or to salvage the machine for adaptation to other work. Separate units also permit independent adjustments of feeds and speeds as desired. ALL-MECHANICAL Rehnberg-Jacobson Drill, Tap, and Index Units combine to form a production machine that is easy to operate, easy to service, and easy to understand.

REHNBERG-JACOBSON MFG. COMPANY

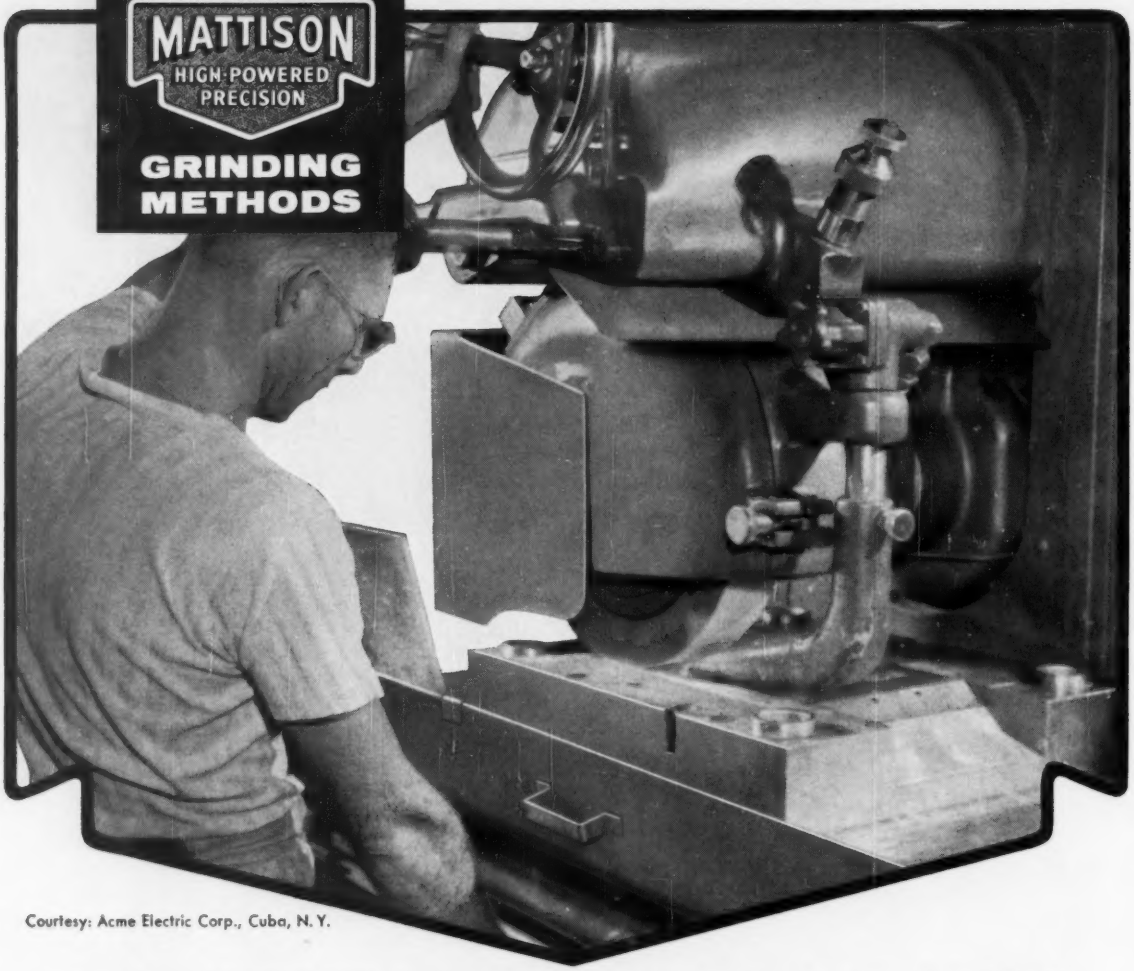
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

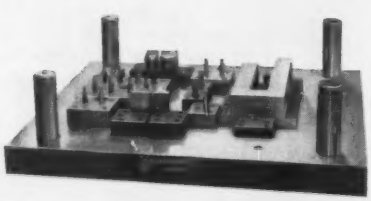
CASE HISTORY NO. 17—LAMINATION DIES

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS



Courtesy: Acme Electric Corp., Cuba, N. Y.

Cuts die sharpening time as much as 37 1/2%, holding parallelism within .0002 in.



Laminating die of Neor tool steel sharpened in 37½ per cent less time on the Mattison.

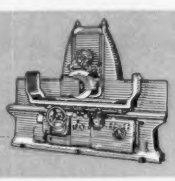
A large volume manufacturer of electric power and control transformers has been able to reduce die sharpening time as much as 37½ per cent with a new Mattison High-Powered Precision Surface Grinder. Parallelism is held within .0002 in. on these dies, an important factor in the finished accuracy of die cut laminations.

These dies present other problems because they must be ground dead flat and have shoulders on each side which cannot be touched. Every requirement of precision and performance has been met by the Mattison grinder to the complete satisfaction of the user. Accuracy is maintained within tenths, if the job requires it.

An example of the increase in speed can be found in the case of one die which took four hours to sharpen on another machine. This is now finished in 2½ hours on the Mattison.

This machine, like every other Mattison grinder, is built with high horsepower, rigid construction, and ability to handle a wide range of work with extreme accuracy at high production rates.

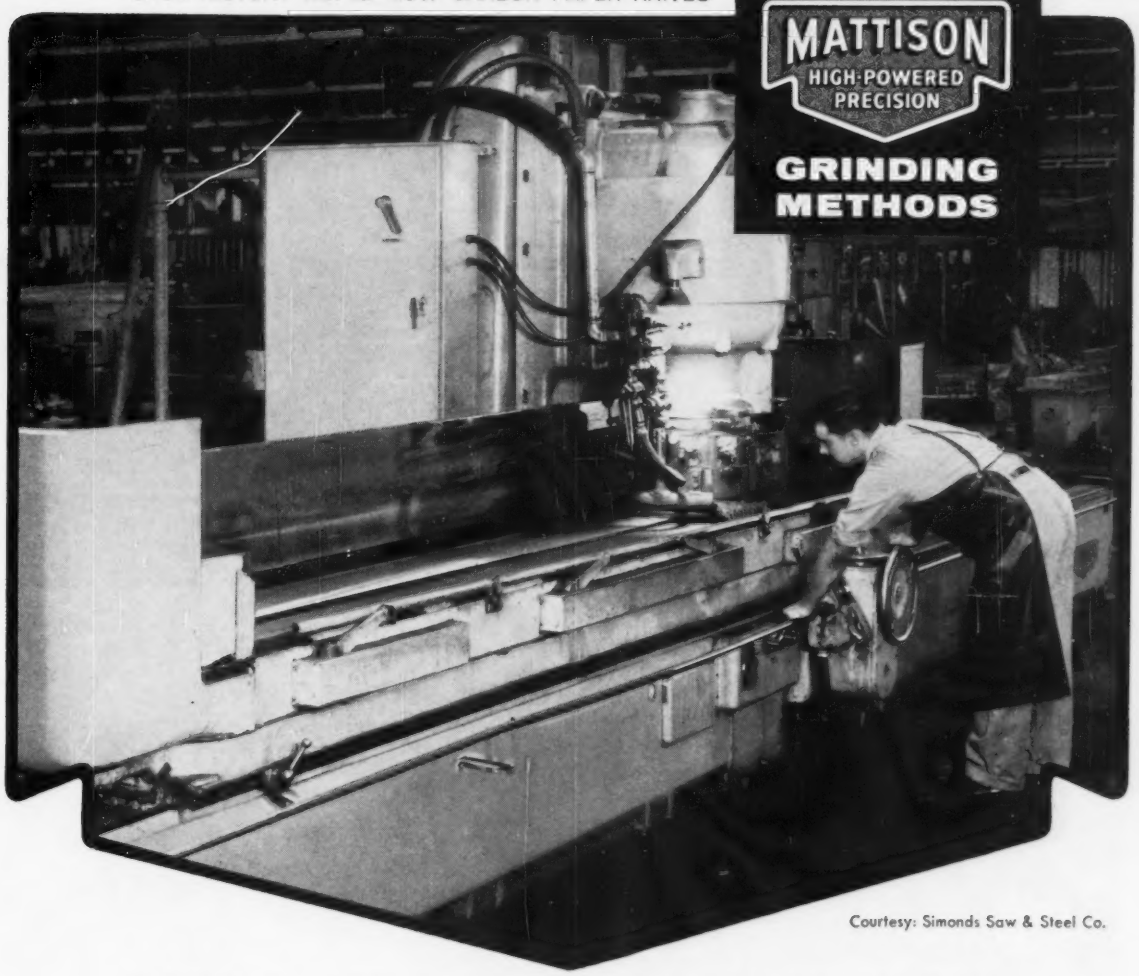
IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 18—LOW CARBON PAPER KNIVES

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS



Courtesy: Simonds Saw & Steel Co.

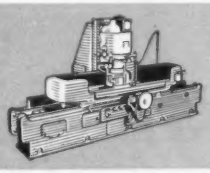
Mattison No. 400's increase production, improve quality, and reduce costs many ways

Mattison No. 400 Vertical Spindle Surface Grinders were installed to improve product finish and simplify material handling by this well-known manufacturer of industrial saws, paper cutting machine knives, and files. These purposes were achieved along with additional benefits. Production has been increased with a resulting reduction in unit cost, and maintenance is down to a minimum.

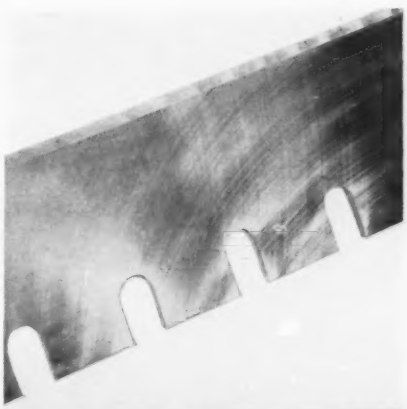
Long carbon steel blades for paper cutting machines are ground on the Mattison. One of the best-liked features of the grinder is the ease with which this long stock can be loaded onto the table. This accessibility has helped reduce setup time and brought downtime between loads to the lowest possible point.

Mattison's 400 Series Grinders feature an extra long and heavy head slide rigidly fastened to the base, and a built-in motor with a special shaft which is the grinding wheel spindle. Quick and accurate positioning are possible with this spindle which holds adjustment securely.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.



HIGH-POWERED
PRECISION
SURFACE
GRINDERS

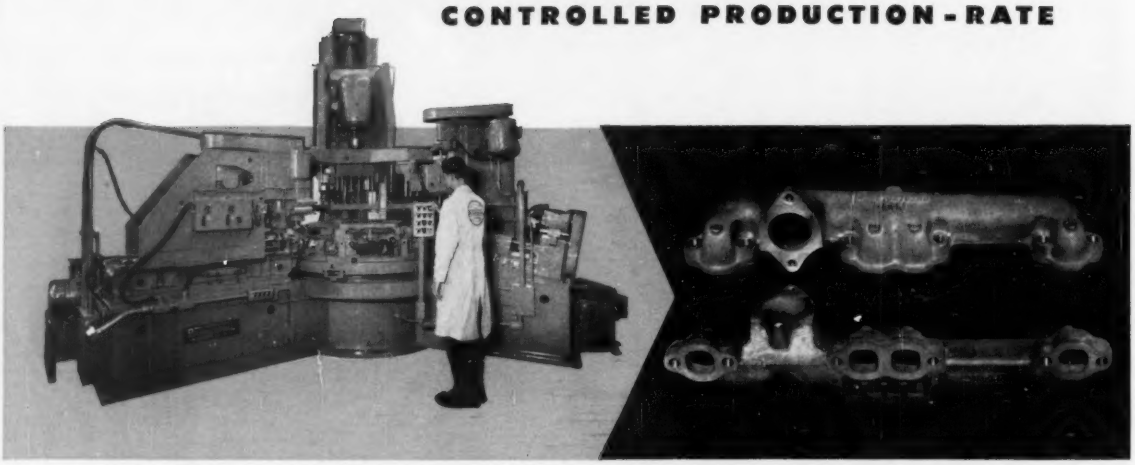


Knife blades for paper cutting machines are long and hard to handle, but they are ground with ease and accuracy on the Mattison.

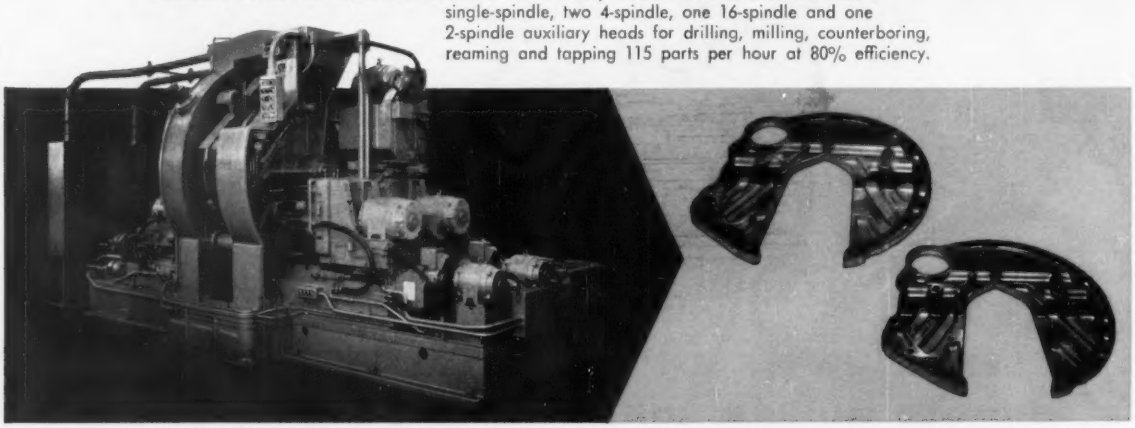
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

BARNESDRIL

UNIT MACHINES
GUARANTEE
CONTROLLED PRODUCTION-RATE



BARNESDRIL SPECIAL UNIT-MACHINE with 6-station rotary index. Machine is tooled with 2 single-spindle, two 4-spindle, one 16-spindle and one 2-spindle auxiliary heads for drilling, milling, counterboring, reaming and tapping 115 parts per hour at 80% efficiency.



BARNESDRIL SPECIAL DOUBLE-END TRUNNION MACHINE for drilling, chamfering and tapping holes in aluminum housing adaptor plate at the rate of 70 parts per hour, 80% efficiency. Tooling includes two 16-spindle, one 11-spindle and one 10-spindle auxiliary head, and one 6-spindle and one 13-spindle lead screw tapping units.

send for complete catalog, bulletin 1504

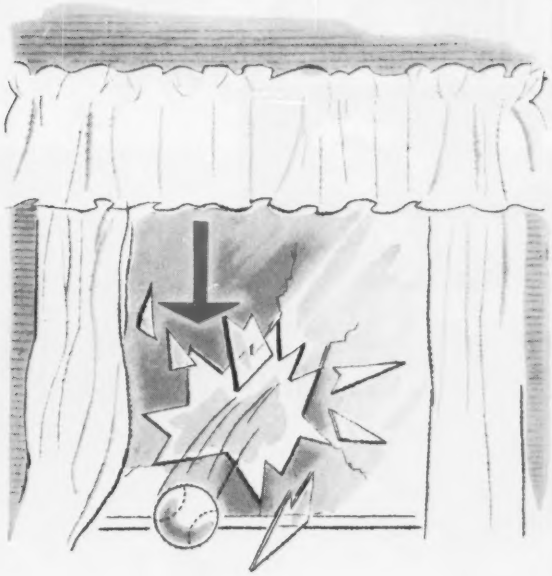
These are Typical Examples —
of BarnesdriL Engineering Skill in combining a specified number of production operations into a single automatic cycle, to produce a required rate of production.
A wide range of work operations is available through the flexibility of rotary index, lateral index, drum index or work transfer mechanisms. Units adapt themselves to vertical, horizontal or angular arrangement. Call your BarnesdriL representative for recommendations on your production-rate problems.

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



a hole here means work...

a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 255

Hollow Mill Maker finds

DBL-2
High Speed Steel

HARD, TOUGH and VERSATILE

The maker of these adjustable hollow mills required a steel that would give top performance in a variety of jobs—turning, tapering, facing, chamfering and trepanning. After thorough testing, Ludlum's high speed DBL-2 was selected.

DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

In addition to these advantages, DBL-2 can be heat treated in the same furnaces and atmospheres as 18-4-1 without fear of harmful decarburization. These DBL-2 blades were heated to 2250 F, oil quenched and drawn twice at 1025 F. After heat treatment, blades easily machined such stock as aluminum, stainless steel, carbon steel, aircraft steel, plastics, bronze, screw stock, cast iron and brass.

There is an A-L tool steel to meet your toughest requirements. Call your A-L representative or distributor today . . . or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

Write For Copy of
"CUTTING TOOL MATERIALS"
This 36-page illustrated booklet analyzes and compares types and covers grade selection for all major classes of cutting tools, etc., invaluable data for production men. Write for your copy today.
Address Dept. M-75

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 5350

AL® FINE TOOL STEELS SINCE 1854

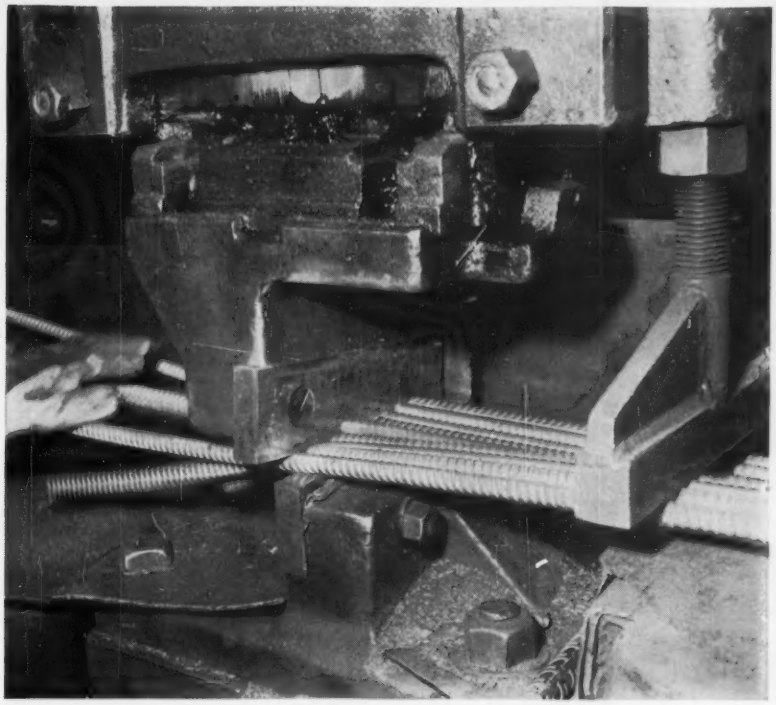
For more information fill in page number on Inquiry Card, on page 255

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Shear Blades Last Twice As Long When Fabricator Changes to Bearcat

For many months a Midwestern fabricator had been using shear blades made of an alloy tool steel. The blades were used in cutting steel reinforcing bars and joists. Production was fairly good, too, as each blade sheared approximately 400 tons of material per side before being redressed.

Then he decided to try, in the same operation, a blade made of Bethlehem Bearcat tool steel. The blade, hardened to Rockwell C-59, was put to work shearing both ¼ in.-x-4 in. plate steel, and reinforcing bars ranging in diameter from ⅜ in. to 1¼ in. The advantage of longer wear and greater economy was soon apparent, for the new blade handled more than 830 tons of material per side —more than twice the tonnage which had been sheared by the former blade.

Bearcat is a tough, general-purpose air-hardening tool steel. It has superior resistance to wear, and is also exceptionally resistant to shock. Bearcat has an air-hardening characteristic, which minimizes quenching hazards and also provides good resistance to distortion in heat-treatment.

In addition to shear blades, Bearcat tool steel can be used economically for such varied items as chisels, punches, gripper dies, rivet sets, hot headers, master hobs and die-casting die inserts.

Why not put in an order for a trial piece of Bearcat today, while you have it in mind? You can't lose by giving it a workout. All you need do is get in touch with your Bethlehem tool steel distributor. He's as near as your telephone. Or order direct from our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Blind Holes Are Dangerous

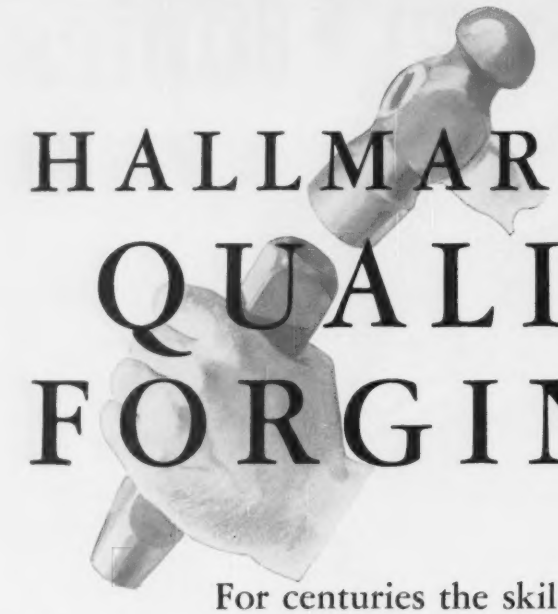
Without proper care, blind holes can be troublesome in the heat-treatment of tools. Typical of blind holes which usually get little attention are holes for studs or dowel pins. The exposure of blind holes to liquid-quenching produces extremely high internal stresses, with the possibility of cracking the tool during heat-treatment, or in service.

If it is not required that blind holes be hard internally, trouble can be avoided by packing the holes, prior to quenching, with clay, asbestos rope, steel wool, or a steel plug. Blind holes are particularly objectionable if they are required to be uniformly hard on the inside surface. This requirement can be met consistently only by using air-hardening steels.

"Teamwork" is the title of a 16-mm color film, with sound, recently released by Bethlehem. The film describes the manufacture of Bethlehem tool steel, and explains its quality-control and heat-treatment. Typical applications of carbon, oil- and air-hardening, shock-resisting, hot-work, and high-speed grades are included.

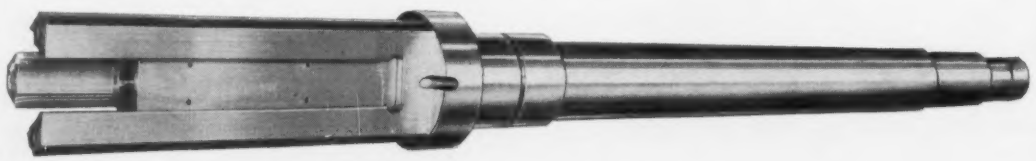
Prints of this 30-minute film are available for showing to distributors, heat-treaters, die-makers, machinists and machine-tool manufacturers, as well as to technical societies and engineering students. If you would like to see the picture, just write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa. It would be well to select a showing date as far in advance as possible.

HALLMARK OF QUALITY FORGINGS



For centuries the skilled craftsman has shown his pride in his workmanship by identifying his work with a "mark".

The trade-mark of the National Forge and Ordnance Company stamped on your forging is your guarantee that the forging has been carefully and skilfully made to meet your specifications exactly.

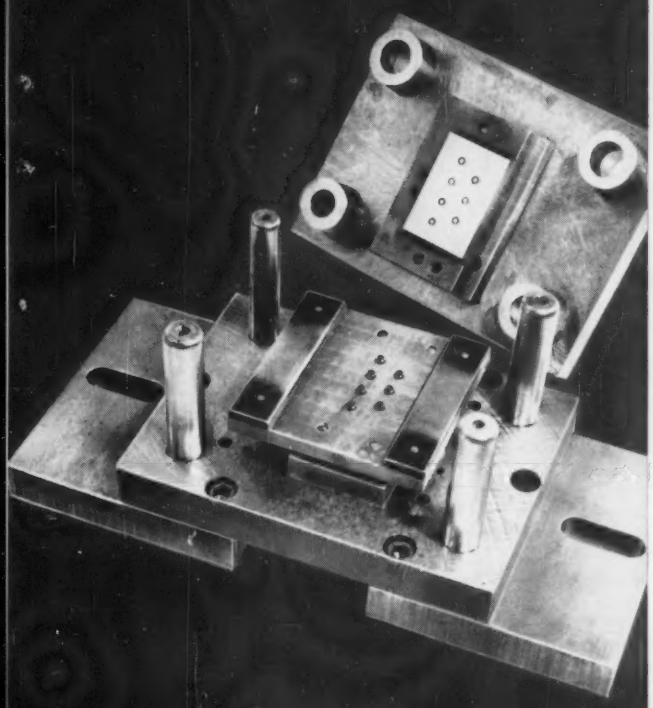


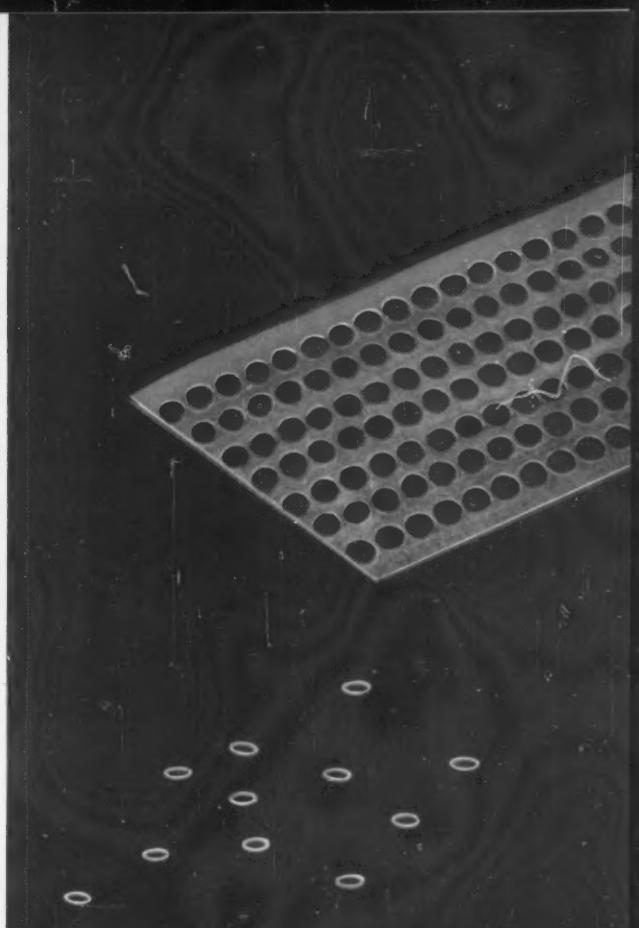
NATIONAL FORGE & ORDNANCE CO.

IRVINE, WARREN COUNTY, PENNA.

For more information fill in page number on Inquiry Card, on page 255

FIELD REPORT: NO. 87





WHICH DIE STEEL WOULD YOU USE HERE to boost production per grind 500%?

These tools blank out dead soft brass washers, .170" O.D. x .100" I.D., .009" thick, on a punch press at 186 strokes per minute. It is an exacting job for a couple of reasons. First, it involves a government contract and strict delivery schedules have to be maintained. Then too, the punch and die are set up to blank seven washers per stroke and have to do this for many millions of pieces . . . and still remain within burr limitations set up by the government. Performance from the steel used in the past was far from satisfactory . . . to maintain schedules, production had to be substantially increased.

Suppose the decision were up to you. Which die steel would you be willing to recommend for steady, trouble-free production?

In this Field Report from customer files, here's what happened: The Carpenter Matched Set Diagram was consulted and Carpenter No. 610 (Air-Wear) was selected. Since then No. 610 has enabled the Company to hold delivery schedules comfortably . . . racking up increases in production per grind as high as 500%. And this is especially significant when you realize that five hours' downtime is involved each time the tools have to be reground. Total parts to date: 5,500,000 . . . and the tool is still good for about 15 regrinds of .003" each.

Why make the tough decisions alone, when Carpenter's service organization is sincerely interested and equipped to work with you? A move in the right direction would be to call your nearest Carpenter Mill-Branch Warehouse, Office, or Distributor, now. *The Carpenter Steel Co., 105 W. Bern St., Reading, Pa.*

Your toolroom can use Carpenter Matched Tool and Die Steels to:

Reduce hardening hazards
Minimize machine downtime
Boost output per grind
Improve product quality

Carpenter STEEL

Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks—Export Address: Port Washington, N. Y.—"CARSTEELCO"

HOW MANY OPERATIONS WHEN YOU PREPARE STEEL FOR PAINTING?

	Operations
Cleaning	1
Rinsing	1
Pickling	1
Rinsing	1
Conditioning	1
Rinsing	1
Drying	1
Total	3

What's wrong with that addition? How can seven operations add up to three operations?

It's easy when you use Oakite Compound No. 33 (or Oakite Compound No. 31) to remove rust or heat scale *at the same time that* it removes oil *at the same time that* it prepares steel (or aluminum) for the lasting adhesion of paint.

That combines cleaning, pickling and paint conditioning into one operation. After rinsing and drying, you have saved the time, the tanks, the space and the solutions for four operations.

O. C. No. 33 is great for removing heavy soil in tanks or for cleaning by hand. O. C. No. 31 is very economical for removing moderate soil in tanks. Each compound is able to strip certain types of paint.

FREE For booklets describing the specific advantages and applications of Oakite Compounds Nos. 31 and 33, just mail the coupon.

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Send me your FREE booklets on Oakite Compounds Nos. 31 and 33. I am especially interested in removing the following soils from ☐ steel, ☐ cast iron, ☐ sheet aluminum, ☐ aluminum castings:

☐ Oil and grease
☐ Drawing compounds
☐ Rust preventives
☐ Identification inks
☐ Carbon smut
☐ Paint
☐ Rust
☐ Heat scale
☐ Tarnish
☐ Welding flux
☐ Soldering flux
☐ .....

Name_____

Company_____

Address_____

Technical Service Representatives in Principal Cities of U.S. & Canada

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

one must set the example

. . . and with high speed steel it's REX

It's a real satisfaction when you set the example by what you make . . . when it becomes a *standard for comparison*. That's why Crucible is proud to have kept REX high speed steel tops in its class for so many years.

But don't take our word for REX's superiority. Try it on your own work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You'll see for yourself why it's the *standard* wherever high speed steels are used.

Remember, REX is made only by Crucible. So call for REX at your nearby Crucible warehouse, or for quick mill delivery — *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

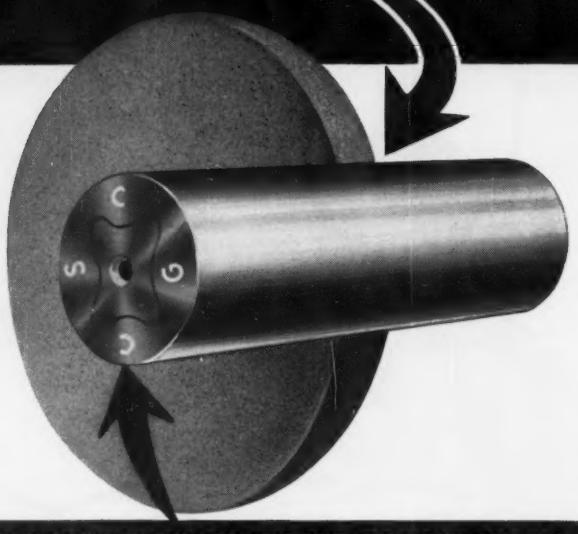
For more information fill in page number on Inquiry Card, on page 255

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information fill in page number on Inquiry Card, on page 255

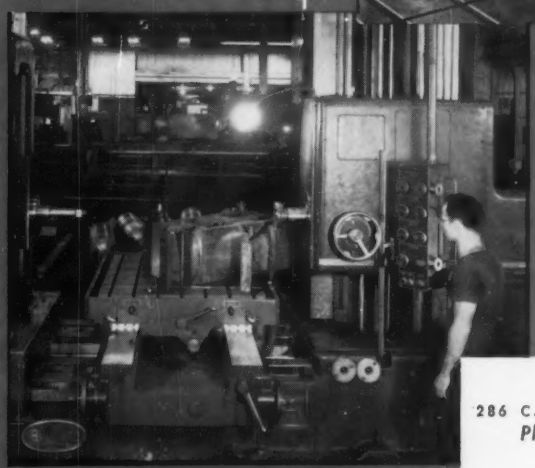
"... the

BULLARD

pendant control ... is sure handy for the operator"

Says boring mill operator at Fuller Company, Manheim, Pennsylvania, manufacturers of conveying equipment, coolers, compressors and vacuum pumps. Also, he says, "there are no levers to mess around with. On the Bullard H.B.M., Model 75, I can mill on a 45° angle in any quadrant instead of having to jockey in one direction, then in the other — like I had to do on the old machine."

the machine is outstanding for ease of operation



For full information on all the cost saving advantages offered by the Bullard Horizontal Boring, Milling and Drilling Machine, Model 75, including screw and rack feed, wide speed ranges, extra rigidity in Bed, Head, Head Post and Rear Post, optical measuring equipment (optional) and Automatic Positioning for head and table (optional),

CALL YOUR NEAREST BULLARD SALES OFFICE OR DISTRIBUTOR OR MAIL COUPON TO

THE BULLARD COMPANY
286 CANFIELD AVENUE—BRIDGEPORT 2, CONNECTICUT

Please send me a copy of the NEW H.B.M., MODEL 75 CATALOG ...

NAME_____

COMPANY_____ POSITION_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

HELIARC Cutting

TRADE-MARK

CUTS ALUMINUM AT SPEEDS UP TO 300 INCHES PER MINUTE

HELIARC cutting, a new process developed by LINDE, brings all the desired features of economical high-speed operations to the cutting of aluminum.

★ **Speeds never before possible:** Normal mechanized cutting speeds are 300 in. per min. in ¼-in. material, 125 in. per min. in ½-in. material, 75 in. per min. in ¾-in. material, and 50 in. per min. in 1-in. plate. If desired, lower speeds can be obtained by simply adjusting the controls.

★ **Straight lines, bevels, contours—no problem:** The new HELIARC cutting process can be used mechanically or manually. Both setups produce high-quality straight line cuts, bevels, circles, and shapes with revolutionary new speed and efficiency.

HELIARC cutting employs a high-temperature, high-velocity, constricted arc between a tungsten electrode and the piece to be cut. The concentrated, columnated energy of the arc stream melts and ejects a thin section of metal to form a kerf. The gas atmosphere (a combination of argon and hydrogen) prevents oxidation of the cut face.

Learn the details of how HELIARC cutting can help you increase production and cut operating costs. Call your LINDE Representative today.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

"Heliarc" and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde
Trade-Mark

For more information fill in page number on Inquiry Card, on page 255

This Month's

GEAR PIX

OVER TWO MILLION rear axle shaft splines have been cold formed in a large automotive plant on a battery of three automatic Roto-Flo spline rollers. Production rate for the 28-tooth, 24/48 diametral pitch splines is 270 per hour on each machine. Tool life is about 150,000 parts per grind.

DOZENS OF AUTOMATIC gear classifiers are now being built by Michigan Tool for 100% inspection control on gears that are being hobbed or shaved. Probe type 3-WAY gear classifiers shown here are in great demand due to freedom from stray chip interference, simplicity of operation and ease of adjustment.

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

This Month's

GEAR PIX

VERSATILE SHEAR-SPEED gear shaper shown here cuts 32 different parts for lift truck transmissions and hoists. Production time is reduced as much as 78%, changeover time is about the same as previous methods. Shown are some of the 32 gears, ratchets, sprockets and splines ranging up to 7 inches in diameter, that are being cut. Parts produced per tool sharpening range from 172 to 1200.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

Here's Proof

The New Thompson Type 2F is a SUPER PRECISION Tool Room Grinder

Webber Gage

WEBBER GAGE COMPANY
12900 TRISKETT ROAD - CLEVELAND 11, OHIO

Mr. Wilson, Vice President
Thompson Grinder Company
Springfield, Ohio

Dear Mr. Wilson:

We recently installed a new THOMPSON Tool Room Grinder to grind Gage Blocks to our specifications and tolerances. The results have been very satisfactory, in spite of the close limits to which the work has to be done. We thought you would be interested in the performance of this machine.

Very truly yours,
WEBBER GAGE COMPANY
George D. Webber

Thompson 2F Grinder Photographed in the Webber Gage Co., Cleveland Plant

COMPARE THIS NEW 8 x 10 x 24 TOOL ROOM GRINDER

When working to a tolerance of four millionths of an inch such as is observed when making Webber Gage Blocks, the rough or preliminary grinding plays an important role in keeping cost of the final finishing within reasonable limits.

Compare These Features:

- HARDENED AND GROUND cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- HARDENED AND GROUND sealed anti-friction vertical slide.
- HARDENED AND GROUND BED WAYS with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.

Handy control panel.

- Elevation micrometer stop graduated in .0001".
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand wheel with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".
- GROUND THREAD FEED SCREW.

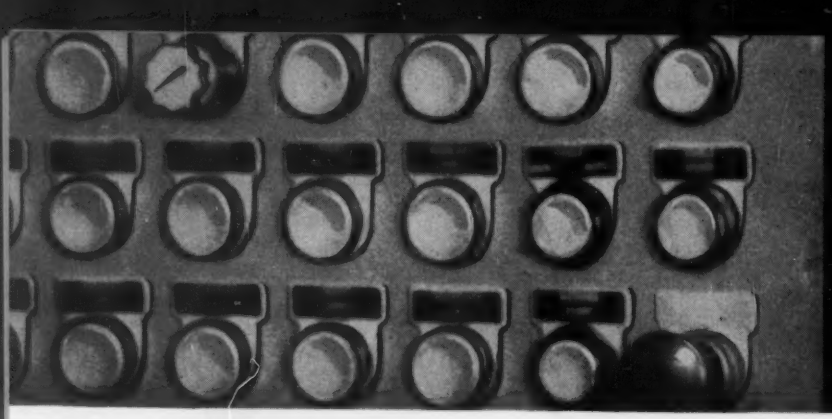
WRITE TODAY for complete specifications and performance data. Address Dept. 10, Thompson Grinder Co., Springfield, Ohio.

The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders for industry.

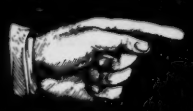
Thompson SURFACE Grinders

The Thompson Grinder Company, Springfield, Ohio

For more information fill in page number on Inquiry Card, on page 255



PUSH-BUTTON ECONOMY



Yesterday, Jones & Lamson broke through the speed barrier with high-velocity metal turning.

Today, advanced engineering at Jones & Lamson again pioneers in attacking a critical cost consideration: the *man-hour* factor.

Here are a few of the engineering innovations which are strategically important for (1) minimizing operator fatigue and human error (2) speedy change-over and retooling, and (3) push-button simplicity of operation:

In Turret Lathes: Geneva saddles and Hydra-Clutch headstocks; automatic thread chasing; one- or two-way tracing combined with normal Turret Lathe operation; Numerical Tape Control for Automatic Turret Lathe.

In Automatic Lathes: Automatic handling; feed-back; gaging; sorting; chip disposal.

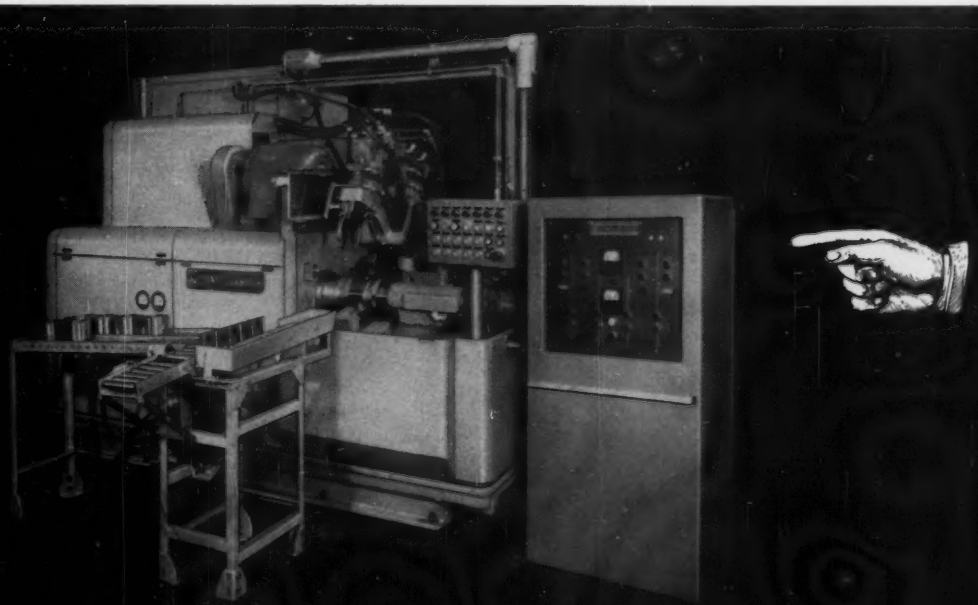
In Grinders: Automatic Tap Grinders; Optical Contour Grinders; automatic handling for Thread and Form Grinders.

These are typical results of our all-out efforts toward machine design that will reduce costs, increase production, and keep both operators and management happy.

The man who needs a new machine tool is already paying for it.

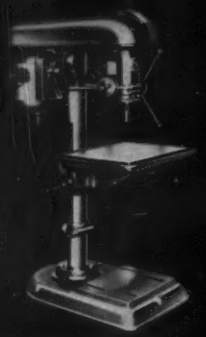
JONES & LAMSON MACHINE CO • 512 CLINTON ST • SPRINGFIELD, VT.

Turret Lathes *Fay Automatic Lathes* *Milling & Centering Machines* *Thread & Form Grinders* *Optical Comparators* *Threading Dies & Chasers*



DELTA®
ROCKWELL

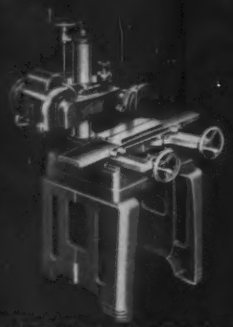
For Metalworking



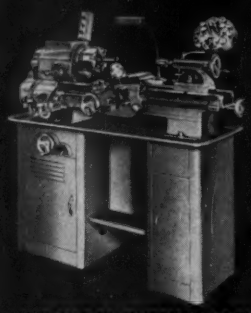
DRILL PRESSES:
17", 14", 14" Super Hi-Sensitive

TOOL GRINDERS: 7" Standard Grinder, 6" Carbide Grinder

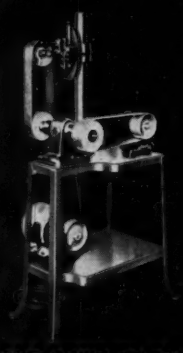
CUT-OFF MACHINES: Wet Abrasive, Dry Abrasive, Non-Ferrous Metal, Wood



GRINDERS: Toolmaker Grinder, Standard Surface Grinder, Chip-Breaker Grinder, Tool & Cutter Grinder



11" METAL CUTTING LATHES:
Five-foot Bed, Four-foot Bed



BELT GRINDERS: 2½"

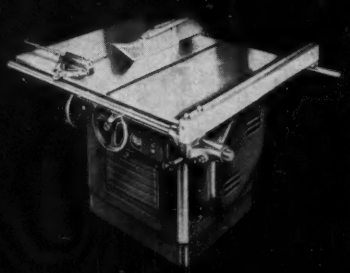
BAND SAWS: 14",
8-Speed Metal-Wood

DELTA QUALITY COSTS NO MORE

DELTA®
ROCKWELL

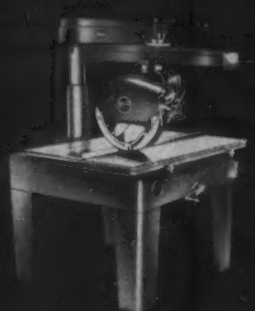
For Woodworking

SHAPER:
Industrial and Bench

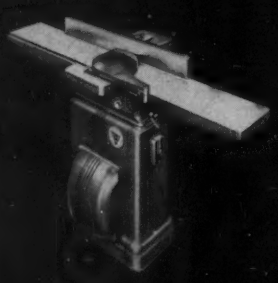


CIRCULAR SAWS:
12", 10" Tilting Arbor; 10" T.A. Bench

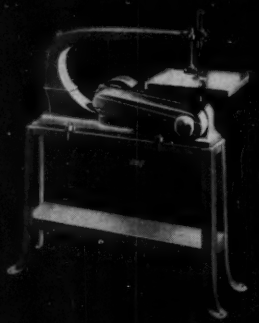
BAND SAWS:
20", 14"



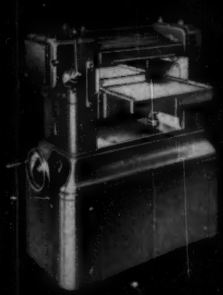
RADIAL SAWS:
20", 14", 10", 9"



JOINTERS:
8", 6" Long Bed



SCROLL SAW: 24"



PLANER: 13" x 5"

ROCKWELL-BUILT

DELTA power tools

World's most complete, most versatile, most useful line of metalworking and woodworking power tools

53 Machines...246 Models...Over 1300 Accessories

SAVE MONEY

...**In Production:** Thousands of plants, large and small, are cutting costs by using accurate, rugged, inexpensive Delta Power Tools to supplement and often replace—heavy, expensive conventional machines. *You* can, too.

...**In Maintenance:** Portable, accurate Delta Power Tools pay for themselves by enabling your own men to handle even the most exacting jobs better, faster, without expensive outside help.

...**In Crating:** Delta Power Tools put production-line efficiency into your shipping room—make possible more output in less time, with less waste.

...**In Every Shop,** large or small—in *your* shop—Delta Power Tools can save on initial investment, on maintenance, on replacement. Get all the facts about Delta Power Tool savings, *then make up your own mind!* Your Delta Dealer is listed under "TOOLS" in the yellow pages of your phone book.

Send for all The Facts NOW!

DELTA ROCKWELL

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

Delta Power Tool Division, Rockwell Manufacturing Co.
614C N. Lexington Avenue, Pittsburgh 8, Pa.

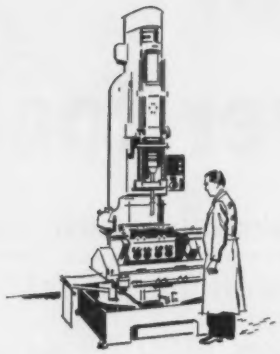
- ☐ Send fact book on using Delta Power Tools teamed with Machine Tools.
- ☐ Send complete Delta Industrial Catalog.
- ☐ Send name of my nearest Delta Dealer.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____



"Today... Rejection rate is NIL!"

A large Midwest pump manufacturing company had run up against an expensive finishing problem. They were using a super finisher with an abrasive stone to cut and polish 410 stainless steel shafting to a four micro finish. The hardness of the shafting was Rockwell B60-90. Although they tried a number of honing fluids recommended by various companies, the rejection of finished shafting was high and stone life was short. On a routine call, Sinclair Industrial Representative P. W. Stevens was asked for his recommendations.

Light-bodied coolant recommended...

Mr. Stevens reports, "Examination showed the need for a light-bodied coolant specifically designed for use as a honing fluid for both ferrous and some non-ferrous metals. From previous experience with a similar problem, I recommended Sinclair HONOL Medium."

Problem solved...

Mr. Stevens continues, "The company tried Sinclair HONOL Medium on a test basis. A follow-up showed they were getting exceedingly fine finish and accuracy, with sufficient carry-off of steel particles during the honing operation. The amount of heat generated was kept to a minimum, thus preventing distortion of parts. The company reports that today their rejection rate is nil. Moreover, all pieces have the desired four micro finish, and stone life has increased considerably. This manufacturer now specifies Sinclair HONOL Medium for his finishing operations, and uses the same product for honing brass."

Why not let a Sinclair Lubrication Engineer help solve *your* lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N.Y.

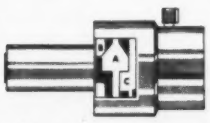
SINCLAIR LUBRICANTS

Cut COSTS

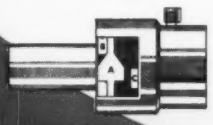
with R and L TAP AND DIE HOLDERS

New Release Mechanism allows for easy adjustment for right or left hand tapping and threading.

Ready to start threading operation, clutch slightly engaged at C.



Instantly engaged to full contact between A and C as soon as tap or die engages work.



Fully released showing ample clearance between contact points of clutch.

Instant engagement at full contact . . . Fast kick out clutch . . . No spring plungers to wear or break . . . No small screws to work loose! Available with shanks of from ⅝" to 1½" in releasing and non-releasing types as well as releasing die holders for acorn dies.

Send for new catalog

See R and L Tools at booth 741, ASTE Industrial Exposition, Chicago, March 19th-23rd.

R and L TOOLS
1825 Bristol Street, Philadelphia 40, Pa.

☐ Send new catalog
☐ Please have representative call.

NAME .....
COMPANY .....
ADDRESS .....
.....

M-3

RIGHT R and L LEFT TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING ROLL HOLDER • KNURLING TOOL

For more information fill in page number on Inquiry Card, on page 255

Mr. Smith goes to Florida

Mr. Smith's books showed an excellent current ratio. His cash position was good; his surplus was substantial. Shortly thereafter, however, he entered a premature retirement.

He had overlooked the fact that a large part of his company's fixed assets were machine tools, and their values shown on his balance sheet were simply bookkeeping entries. Those values didn't reflect obsolescence, nor show how expensive indirect labor, nonproductive floor space and downtime can be.

A closer look at your balance sheet may reveal the wisdom of investing in new production equipment. Its high rate of return makes good balance sheets better.

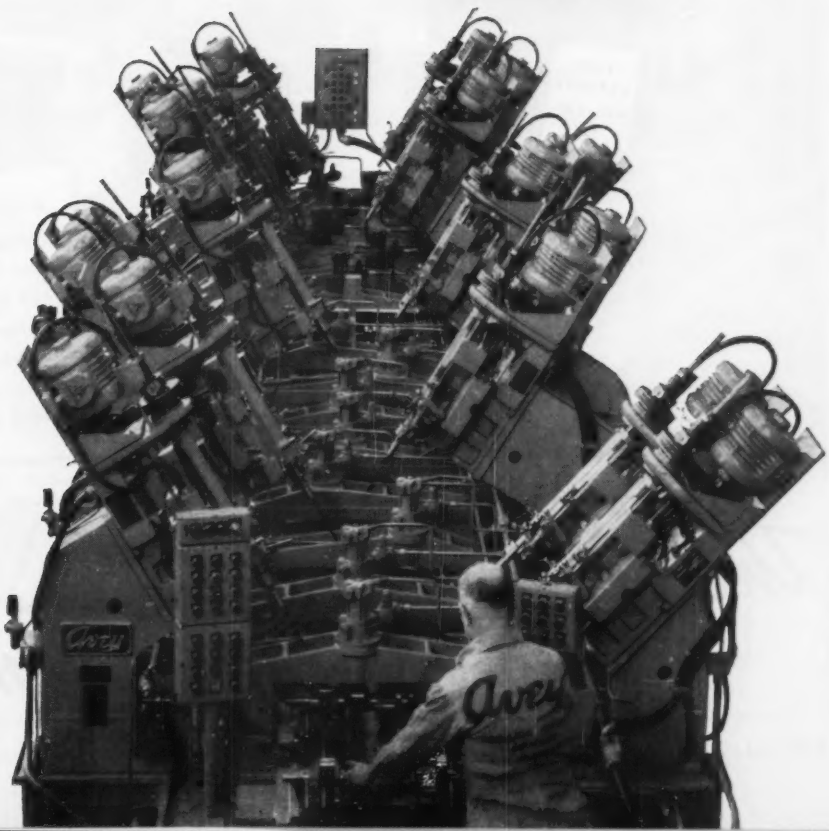
The 14-station machine has Line-O-Dex indexing, automatic hydraulic clamping and positioning, and drills ¼" holes with Aveydraulic Torquematic deep hole drilling units.

When this order is complete, or the part changes in design, the Avey standard units can be rearranged for a new job ▶*an economical way to extend the life of your investment.*

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

Avey



Come to the ASTE Show!

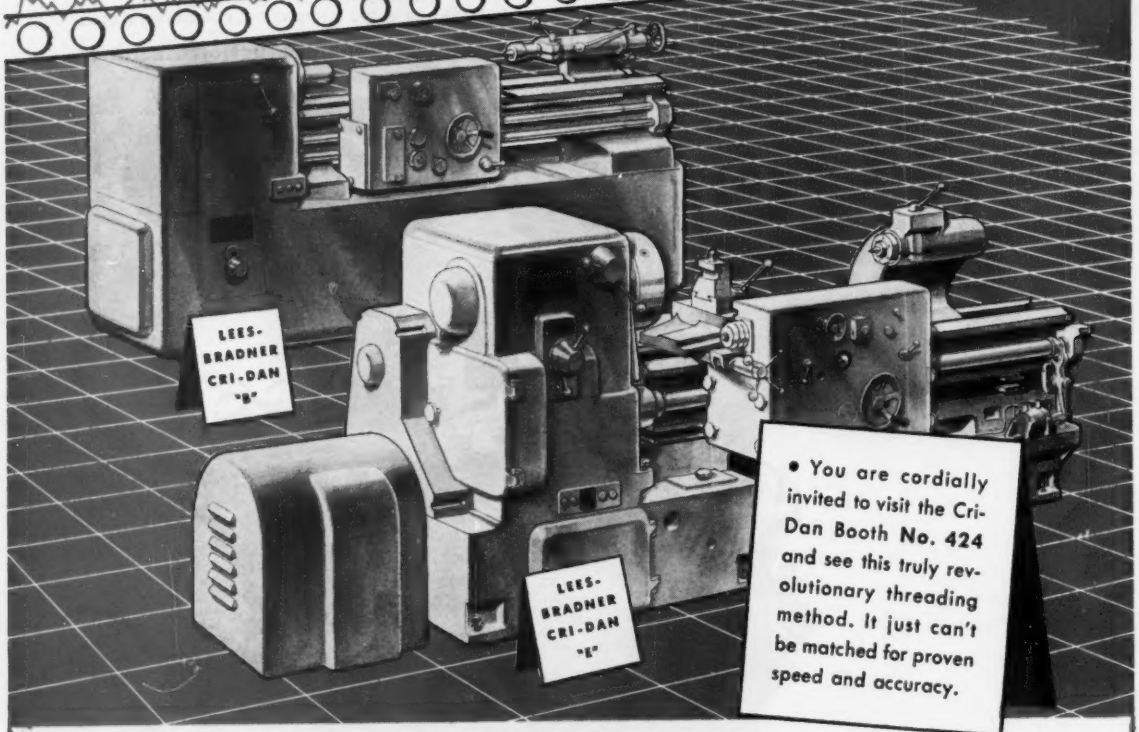
INTERNATIONAL AMPHITHEATER

CHICAGO · MARCH 19-23, 1956

STARRING

THE CRI-DAN

"THE ONLY PROVEN SINGLE POINT THREADING MACHINE!"



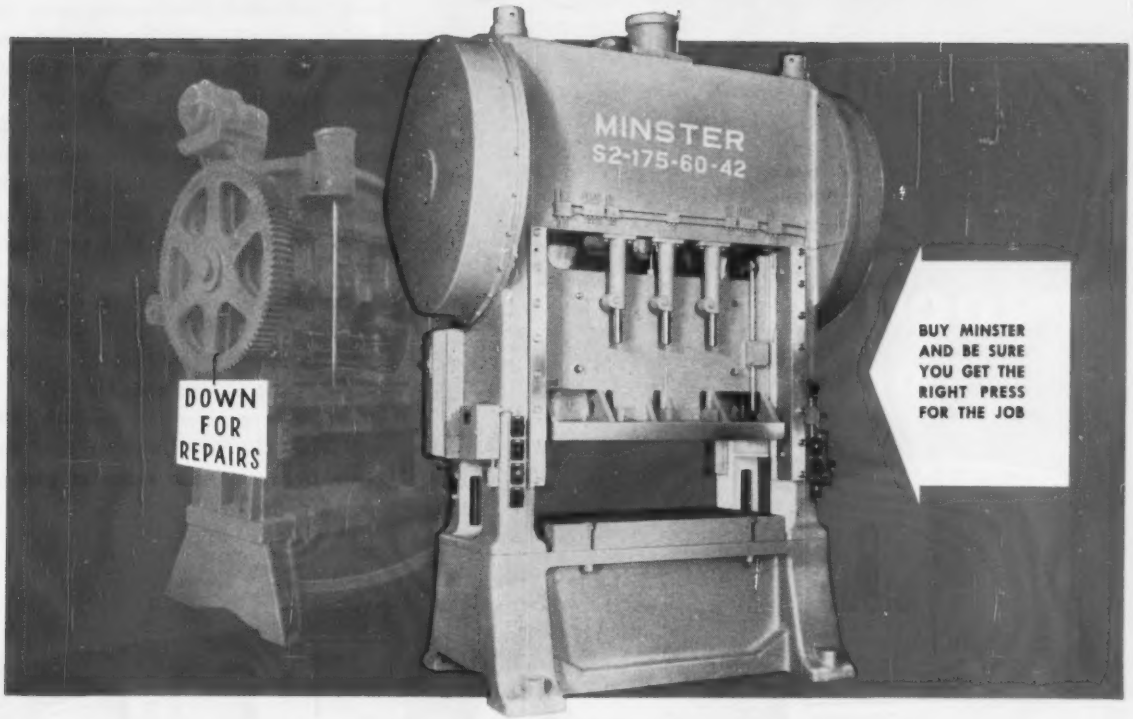
• You are cordially invited to visit the Cri-Dan Booth No. 424 and see this truly revolutionary threading method. It just can't be matched for proven speed and accuracy.

CRI-DAN DIVISION

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

A Minster Press means
LESS DOWNTIME



Here is why Minster Presses on the job mean more production hours and less downtime for press repair!

1 ADVANCED DESIGN to give you the value of the best practices and latest improvements in presses . . . Box type construction for less deflection and better bearing support . . . Slides having longer ways fully supported and widely spaced . . . Large diameter connection screws . . . Method of taking up wear in lower connection bushings . . . Barrel slide adjustment on all sizes over 60 ton.
Clutch controls, both air and electrical, to improve press operation and production methods.

2 MINSTER'S PATENTED COMBINATION FRICTION CLUTCH AND BRAKE . . . One single automatically synchronized unit having air engaged multiple disc clutch and spring applied brake . . . Fast controlled engagement or disengagement at any point on 360° surfaces . . . Shock absorbing action . . . Exceptional friction surface life. *No more sledge hammer engagement, fast wearing and hard to fit replacement parts.*

3 PRECISION FITTING where it counts . . . Ways scraped to master gauges and square to the slide face . . . Bed scraped to surface plate . . . Bearing bores and bushings honed to fit . . . Ground spacers for maintaining proper gib clearance . . . Ground and roll burnished crankshafts.

4 MAINTENANCE INFORMATION AND OPERATOR INSTRUCTION applying to your press . . . A guide to preventive maintenance and operator training.

Let Minster help you plan your press replacement program

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

MINSTER®

PRESSES

For more information fill in page number on Inquiry Card, on page 255

You can draw
— form THIS...

from THIS...

with simple, inexpensive
die-sets on

FARQUHAR PRODUCTION LINE PRESSES

THE economies of automation and constant-flow set-ups need not be dependent on high cost dies. The versatility of Farquhar Production Line Hydraulic Presses makes it possible to draw and form intricate shapes by progressive operations using simple, low cost die-sets.

The economy of these presses is not confined to reduction of tooling cost. For instance, the four column presses illustrated here provide areas for loading and unloading from four directions providing maximum flexibility in setting up a constant flow of material in a production line operation.

Maintenance costs, too, are minimized by sound engineering and construction. Easy accessibility to all moving parts is an important maintenance feature.

Farquhar engineers are ready to help you select the right units for your purposes from our wide range of presses.

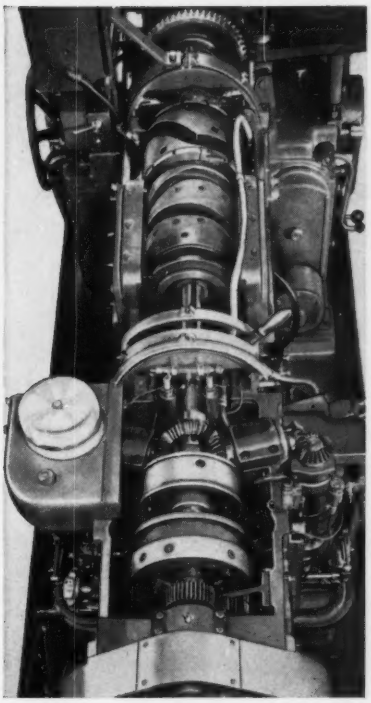
Send for this fact-full catalog... it describes the basic types of Farquhar Production Presses. Write: A. B. Farquhar Division, The Oliver Corporation, Press Dept., York 42, Pennsylvania.

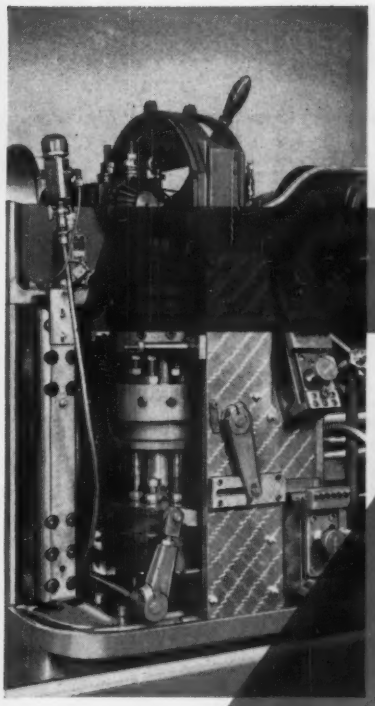
OLIVER

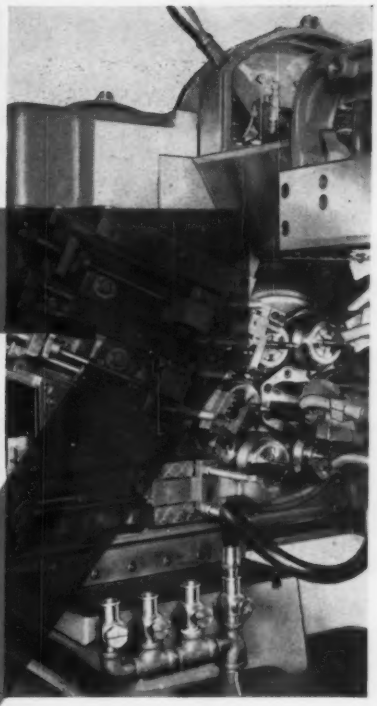
FARQUHAR

PRODUCTION PRESSES

DRAWING • FORMING • FORGING • STRAIGHTENING • BENDING • FORCING • ASSEMBLING • EXTRUDING • AND OTHER OPERATIONS





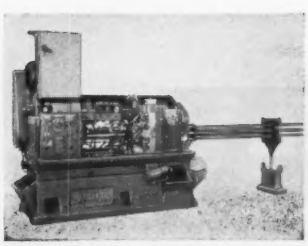


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.

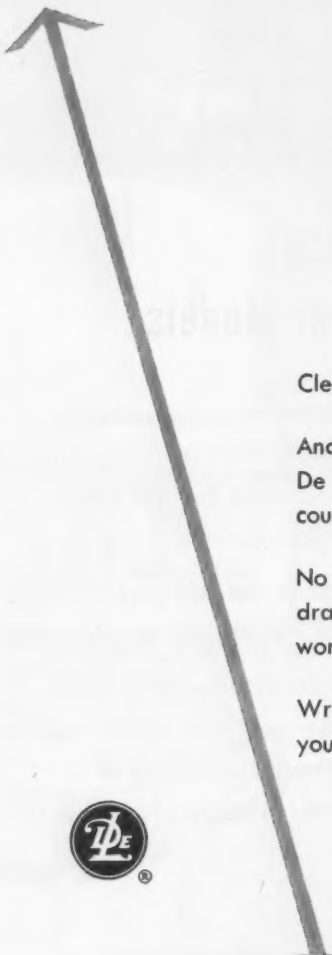


Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information fill in page number on Inquiry Card, on page 255

NO MATTER HOW YOU USE OIL DE LAVAL KEEPS IT CLEANER, DRYER!



Clean, dry oil is essential in any operation.

And the best way to keep it clean and dry—is with De Laval Purifiers and Clarifiers . . . proved best in countless major plants all over the nation.

No matter how you use oil . . . for lubricating, machining, drawing, honing or many other operations in metal working . . . De Laval is the one answer to dry, clean oil.

Write for all the facts that can put more profits in your picture . . .

DE LAVAL
purifiers and clarifiers for factory oils

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

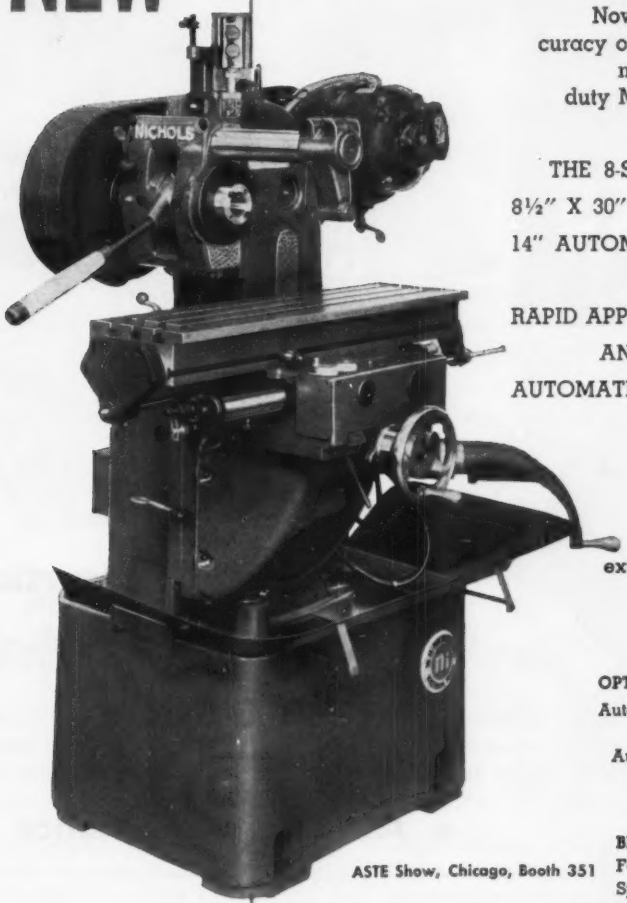
"Anything almost right is wrong"

W. H. NICHOLS
1873 1951

NEW NICHOLS

Semi-Automatic Miller

Now Nichols matches the unequalled accuracy of its famous hand-miller in the new semi-automatic heavy duty Miller #8-SA.



THE 8-SA MILLER BY NICHOLS PROVIDES
8½" X 30" TABLE WITH 3 T-SLOTS
14" AUTOMATIC PNEUMATIC LONGITUDINAL TABLE FEED WITH
RAPID APPROACH, SLOW CUTTING FEED,
AND RAPID RETURN . . .
AUTOMATIC TABLE WAY LUBRICATION.

The Nichols 8-SA is a production miller with vertical and transverse table screw feed featuring a **heavier knee** and **extra wide saddle** for greater bearing surface . . . air equipment **inside** the saddle saves space.

OPTIONAL:

Automatic Pneumatic Down Feed To Spindle Head
Automatic Pneumatic Transverse Table Feed
Automatic Milling Cycle through synchronization of any two pneumatic feeds.

BRIEF SPECIFICATIONS: • Table 8½" x 30" Feed 0-60" min. • Rapid traverse 300" min.
Spindle speeds available up to 5000 rpm.
Range: Longitudinal table feed 14"
Transverse table travel 6"
Vertical travel of knee 11"
Rise and fall of spindle head 4½"

ASTE Show, Chicago, Booth 351

Write for catalog on the Nichols way to increase production and lower costs. Reservation may be made for sound, color film, "The Miller That Uses Its Head".

ni

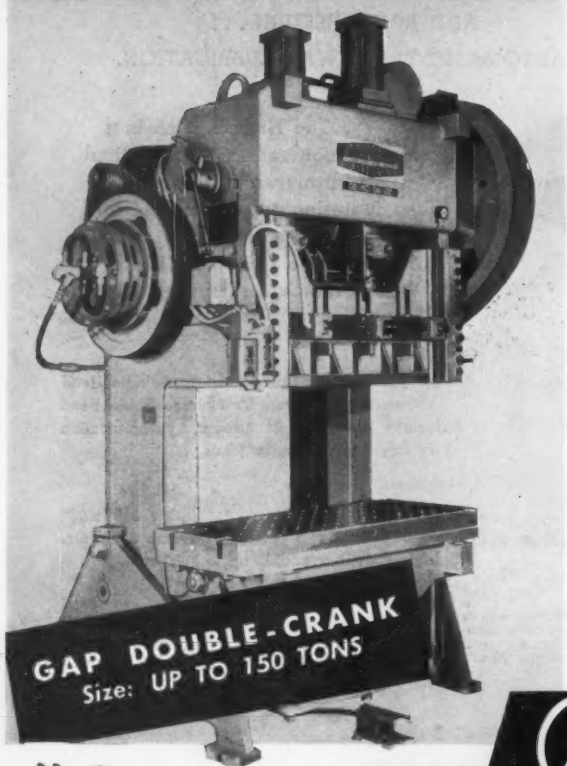
W. H. NICHOLS COMPANY
WALTHAM 54, MASS.

National Distributors
NICHOLS-MORRIS CORPORATION • 76-E Mamaroneck Ave., White Plains, N.Y.

JOHNSON

INTRODUCES

TWO NEW SERIES of PRESSES



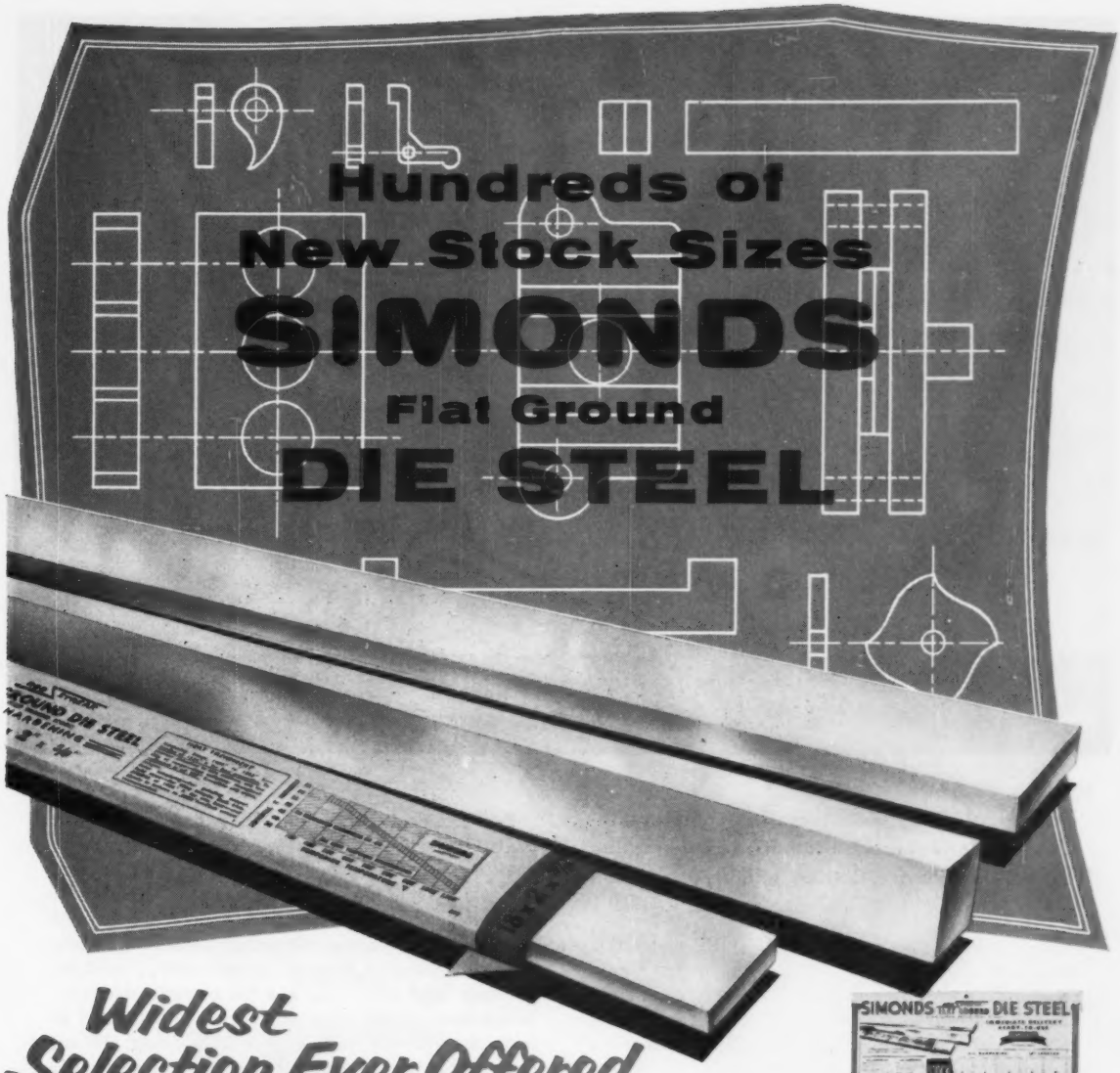
- **Box Type Ram**
- **Steel Fabricated**
- **Air Clutch (low inertia)**
- **Electrical Controls**
- **Bronze Gibs and Ball Seat**
- **Air Counter Balance**

Write for Bulletin 1956

Also ***22 MODELS OF OBI MECHANICAL PRESSES from 16 to 125 Tons Capacity***

Johnson MACHINE and PRESS CORP.

620 WEST INDIANA AVENUE • ELKHART, INDIANA



Widest Selection Ever Offered

Now you can get hundreds of new stock sizes of Simonds high-grade, precision-ground tool and die steel. Sizes that formerly were special are now available from stock at regular prices. Sizes you asked for to help you save time and money. "1001 sizes for 1001 uses" in either OIL or AIR Hardening type steel.

OIL HARDENING TYPE — Non-deforming, spheroidize-annealed for best machinability and consistently uniform hardenability — from Simonds' own steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. Individually packaged (18" and 36" lengths) with simplified heat treating instructions.

AIR HARDENING TYPE — Non-deforming, spheroidize-annealed, 5% chrome — more wear-resistant yet easy to machine and heat treat with uniformly excellent results — another product of Simonds' steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. 36" lengths. Individually packaged with heat treating instructions.

FREE WALL CHART

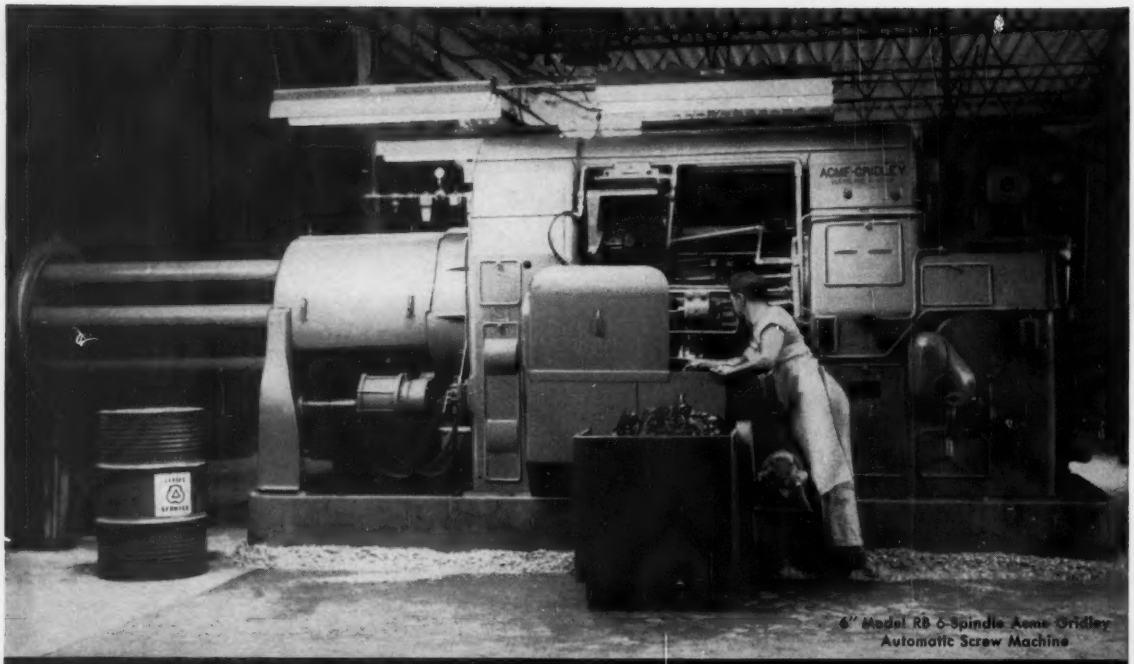
Ask your Simonds Distributor for a copy of this New Chart (18" x 31") giving full range of Stock Sizes now available.

For Fast Service from Complete Stocks

Call your SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada



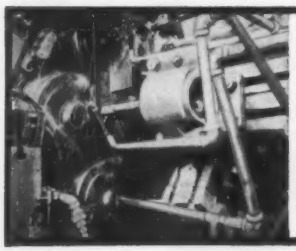
Owned by Jessen Manufacturing Company, today's most advanced automatic screw machine uses Cities Service Cutting and Hydraulic Oil

Weighing 39 tons and powered by a 60 H.P. motor, this 6-inch, 6-spindle Acme Gridley Automatic Screw Machine is one of the only six now in existence . . . and the only one owned by a job shop. Featuring a combination pneumatic-hydraulic operation, it can turn out a single load of stock weighing 3 tons!

The owner is Jessen Manufacturing Company of Elkhart, Indiana—since 1923 famous for keeping on top of new developments. It's not strange, therefore, that for this advanced new machine they chose a top quality coolant—a Cities Service cutting fluid.

Says President J. H. Jessen: "We're happy to say that the Cities Service cutting oil we use today is one of the finest all-around cutting oils we have ever used. In years past, we felt that if a cutting oil was good, it had to be black, heavy, and odorous. Cities Service has changed our minds with a cutting oil that has outstanding cooling abilities, good chip drain-off, is anti-weld . . . and yet possesses light, clear color and has no noticeable odor. In addition, Cities Service Pacemaker Oil used in hydraulic systems, and Amplex Lubricating Oil are doing an outstanding job throughout our shop. We proudly recommend *all* these Cities Service Oils."

For more information on the complete line of Cities Service cutting fluids, call in a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



Light, Clear Coolant in Acme-Gridley Automatic is Cities Service cutting oil. "Outstanding cooling, anti-weld, and chip drain-off ability," says Jessen. Firm also praises Pacemaker Oils, used in their hydraulic operations.

Jessen Mfg. Company., Inc. Mr. Jacob Jessen, Pres., in business since 1923, has earned reputation of keeping on top of new developments. In 1935, he was one of the first to install 6-spindle, anti-friction bearing screw machine.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

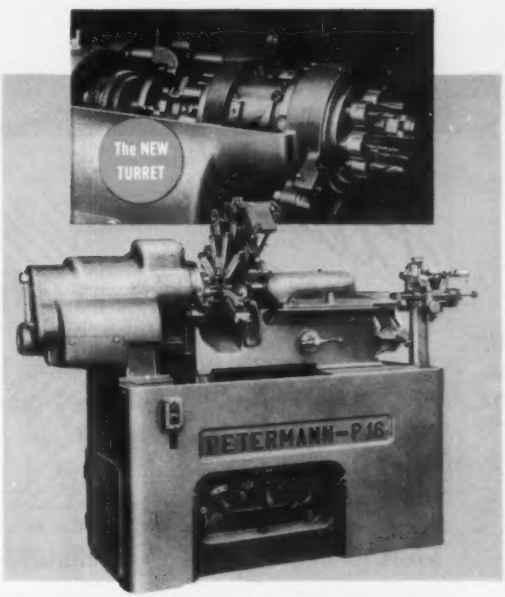
BE SURE TO SEE *(in Booth 353)*

these Machines in Operation

A.S.T.E. SHOW
CHICAGO,
March 19 thru 23

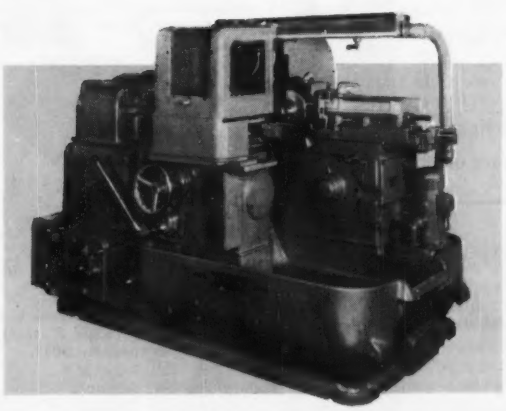
MIKRON

Gear Making Machines • Thread Milling Machines
9 Sizes and Styles



PETERMANN

Automatic Lathes • Gear and Pinion Cutters
6 Machines

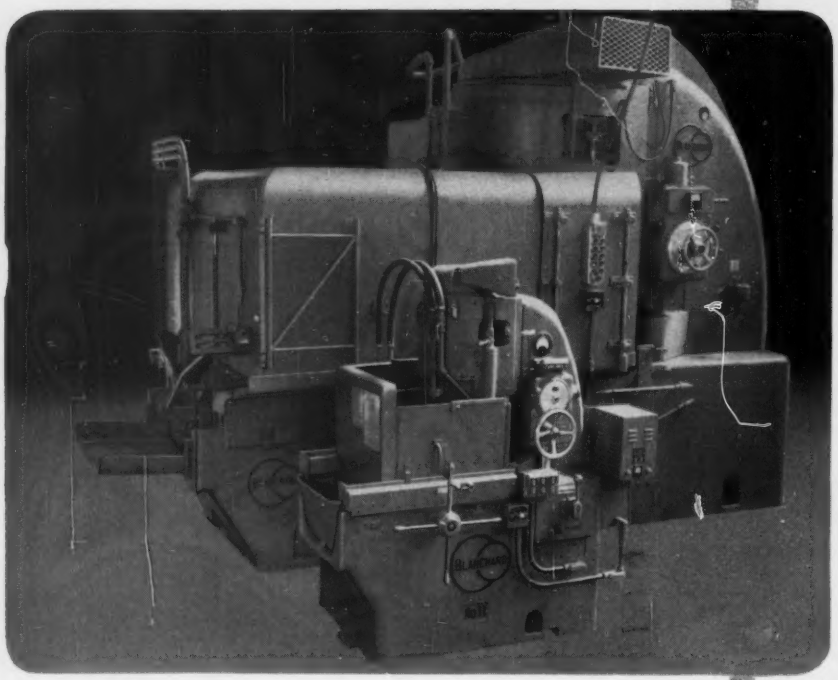


TAREX

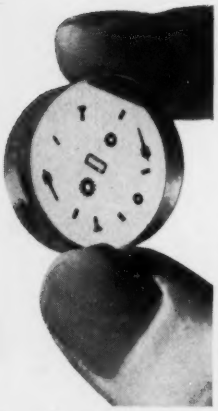
Single Spindle Automatic Lathes
for Bar Work and Chucking • 2 Sizes

RUSSELL, HOLBROOK & HENDERSON, INC.

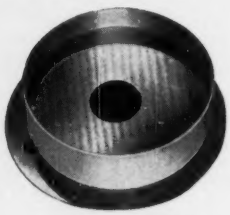
292 Madison Avenue, New York 17, N. Y.



V-488



Tiny watch gears, pinions and ruby bearings — flat and parallel — to a dimension tolerance of .0002″.



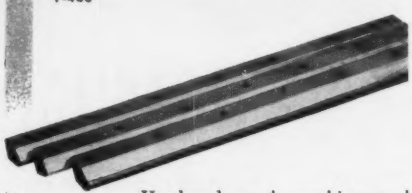
To 3 micro-inches and flat within *one* light band.

Please give us a chance!

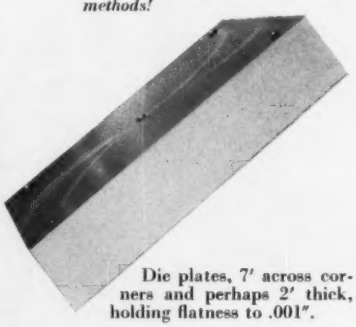
We *know* we can do *your* flat surface jobs. We've done them all — tiny watch parts . . . steel plates 7 feet across corners . . . copper and ceramics . . . *perfectly*. Just give us the correct wheel . . . (Blanchard wheels are preferable).

Blanchards regularly grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001″, with dimension tolerance of .0002″ and surface finish to better than 3 micro-inches.

Honest, we Blanchards (15 models) work fast and inexpensively — whether the job requires precision grinding or rapid removal of stock. Give us a chance to prove we're the best investment you ever made.



Hardened steel machine tool ways, 2½″ x 3½″ x 50″, ground on 6 sides, flat within .001″ with surface finish of 5 micro-inches — *5 times faster than other methods!*

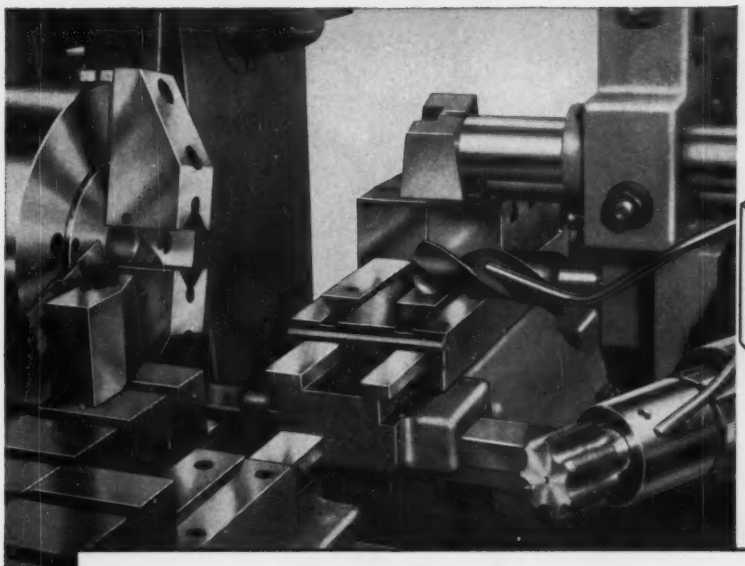


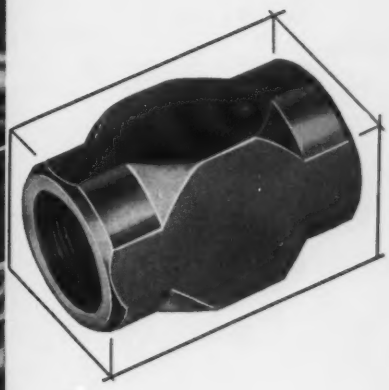
Die plates, 7′ across corners and perhaps 2′ thick, holding flatness to .001″.

Send for free copies of "Work Done on the Blanchard" (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.





From STAINLESS to STEAM TRAP

machined FROM THE SOLID in just 6.90 minutes

on a P&J 4-U Automatic Chucking Turret Lathe with

POTTER & JOHNSTON ENGINEERED TOOLING

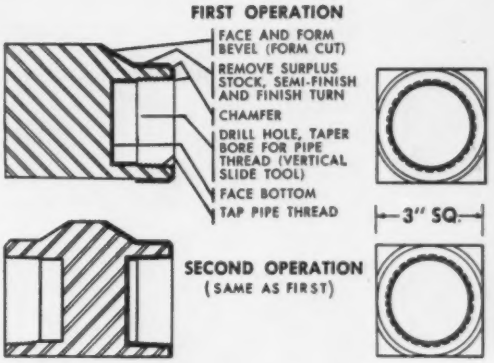
HERE ARE THE JOB FACTS:

PART NAME: Steam Trap Body

MATERIAL: 3" Stainless Steel Cut-Off Stock

MACHINING: 2 Completely Automatic Cycles, 11 Cuts, Each including a Taper Bore and Tapping a Pipe Thread

FLOOR-TO-FLOOR TIME: Only 3.45 Minutes per Cycle; A Completed Piece Every 6.90 Minutes!



HEAVY LINES INDICATE MACHINED SURFACES

But you can't tackle jobs like this *profitably* on machines built for yesterday's easy-going standards. Handling complex cuts and heavy metal removal on tough modern alloys with a speed, economy and accuracy that can meet *today's* (AND tomorrow's) highly competitive standards takes a P&J 4-U Automatic. Here is the advanced design, added rigidity, extra speed and power needed to take full advantage of faster cutting carbide tooling . . . to turn problems into profits!

TAKE ADVANTAGE OF P&J DIRECT-FACTORY SERVICE

To serve you best, all P&J Automatics are made available to you through Potter & Johnston and Pratt & Whitney direct-factory Representatives. For full information on 4-U and other advanced-design P&J Automatics . . . and for expert application and tooling engineering . . . phone or write the P&W Branch Office conveniently near you. There is no obligation for this technical service.

Precision Production Tooling for more than Fifty Years

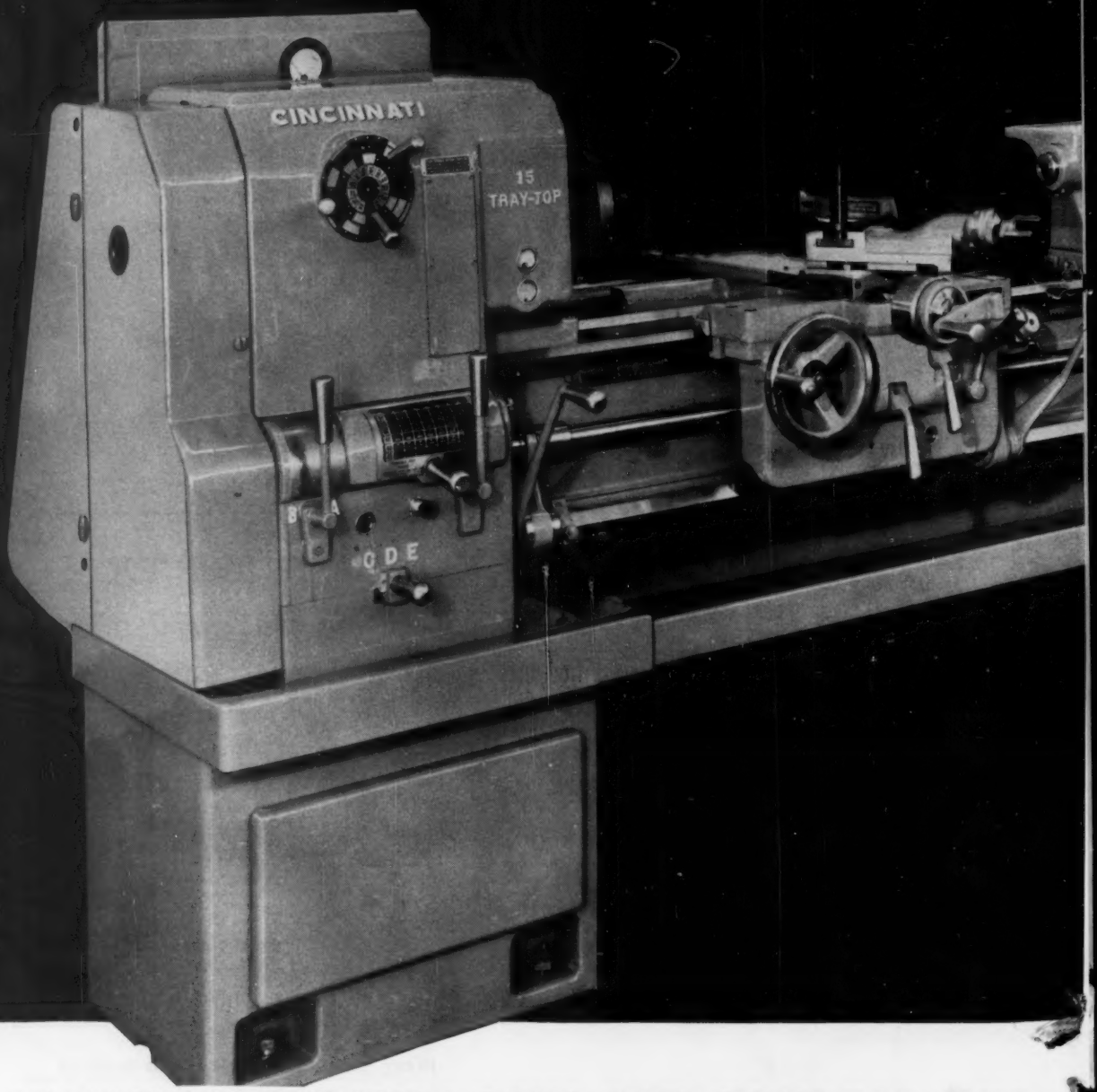
POTTER & JOHNSTON COMPANY

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT

For more information fill in page number on Inquiry Card, on page 255

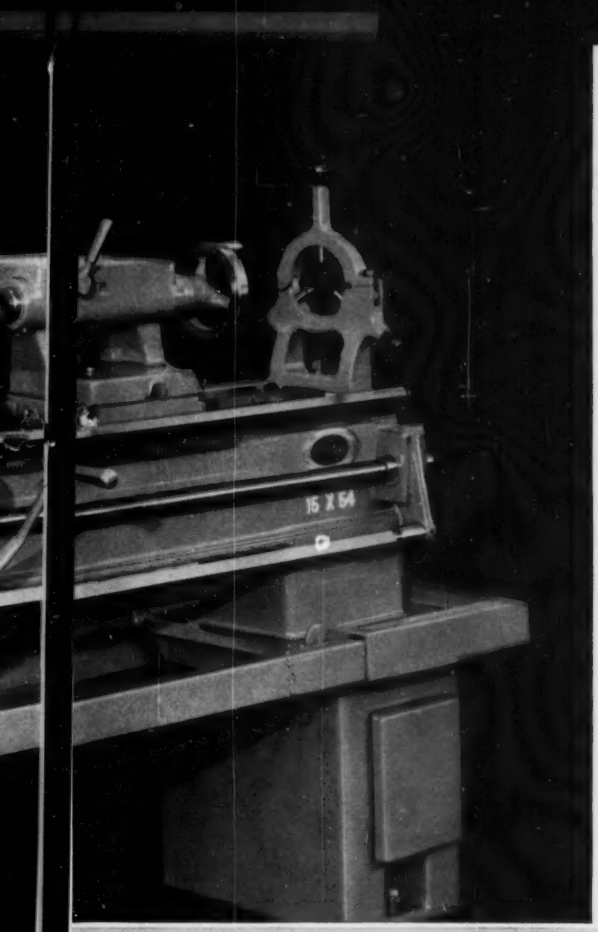


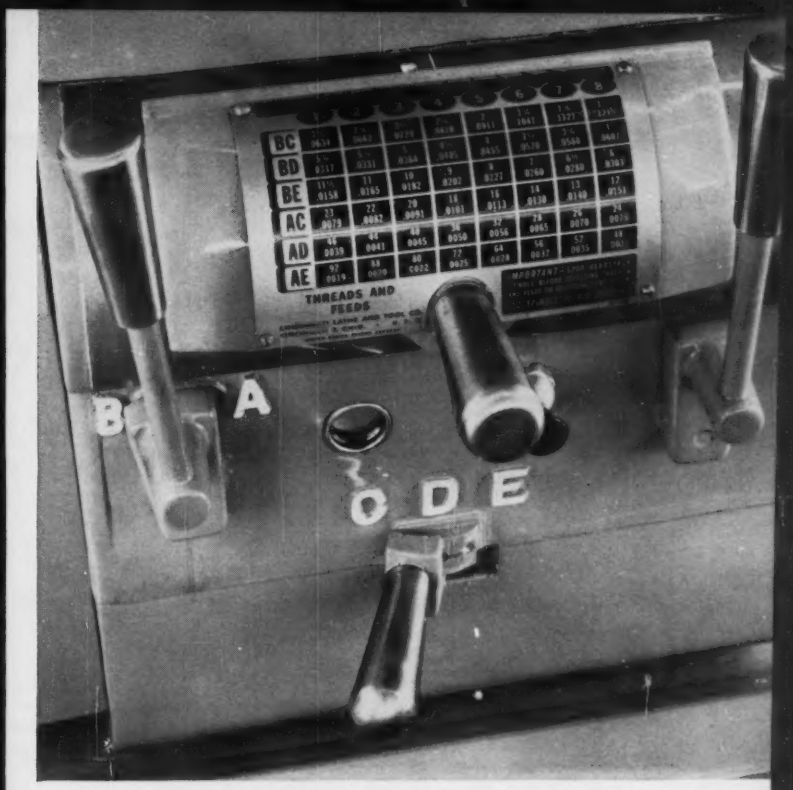
CINCINNATI EXPANDS LOW-COST TRAY-TOP LINE —NOW THERE ARE SIX NEW LATHES

The good news here takes two directions: (1) Cincinnati Tray-Tops are available now in 10″, 12½″, 15″, 18″, 21½″ and 26″ sizes, and in engine, toolroom and fixed gap bed models. (2) The complete Tray-Top line is designed to provide *new* production convenience and *new* operator safety.

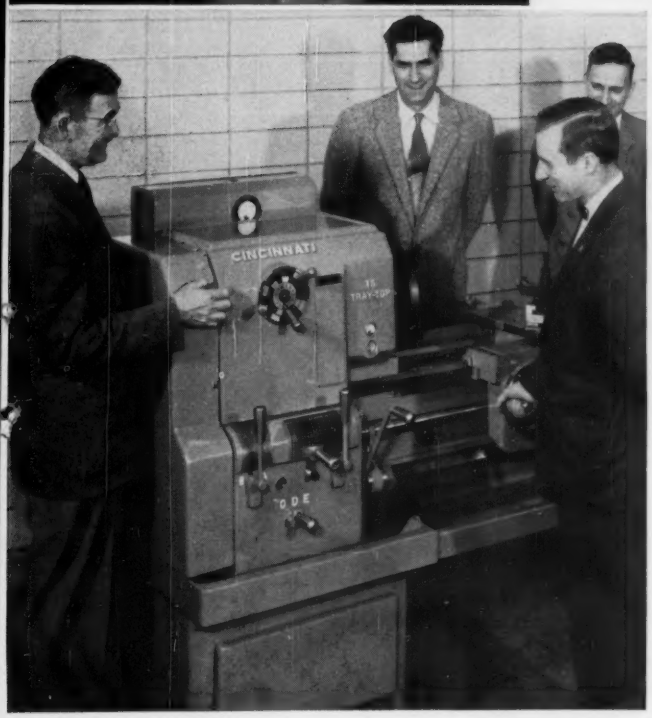
To job shops, maintenance shops, schools and production shops, the new, complete line of Tray-Tops means that the majority of jobs can now be done on modern standard machines at a modest primary investment.

In every respect, Cincinnati Tray-Tops are precision machines, built to hold their accuracy through years of continuous hard work. Your local Cincinnati dealer will explain the solid business advantages you get with Tray-Tops. For the name of dealer nearest you, plus complete catalog material, write Cincinnati Lathe and Tool Co., 3267 Disney, Cincinnati 9, Ohio.

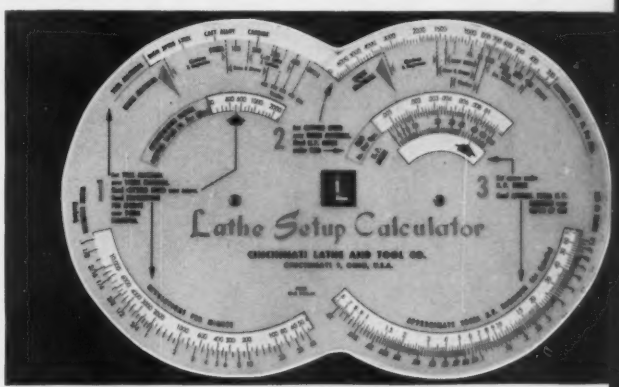




TOTALLY ENCLOSED QUICK-CHANGE BOX guards gears against dirt, chip and foreign matter. 54 thread and feed changes: range of 1½ to 9 threads per inch; range of feeds, .0019 to .1215.



COLOR-MATCH SPEED SELECTOR is simplicity, itself. No more reference to index plates and lever positions; just match up the color lines. Standard spindle speed ranges are 35 to 1200 rpm; 25 to 980; or 16 to 640; with higher ranges available at extra cost. Pressurized lubrication to bearings and gears. Three-bearing spindle. 3″ diameter spindle hole available on larger sizes.



Get your Cincinnati Turning Calculator now by filling in and mailing coupon below.

With this new, attractive calculator, complete with instruction booklet—

IT'S EASY

. . . to select speeds and feeds for your job lot, toolroom or initial production runs.

IT'S SIMPLE

. . . to determine the most economic cutting speed for your high production runs.

JUST

. . . print your name, firm, address, city, zone and state, and mail with $1 (check or money order) to Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio.

Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio, U.S.A.

Enclosed is $_____ in payment for _____ Cincinnati Turning Calculator. Please ship to:

Name _____

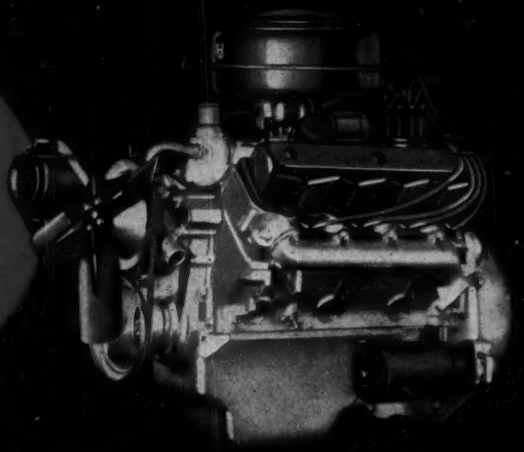
Firm _____

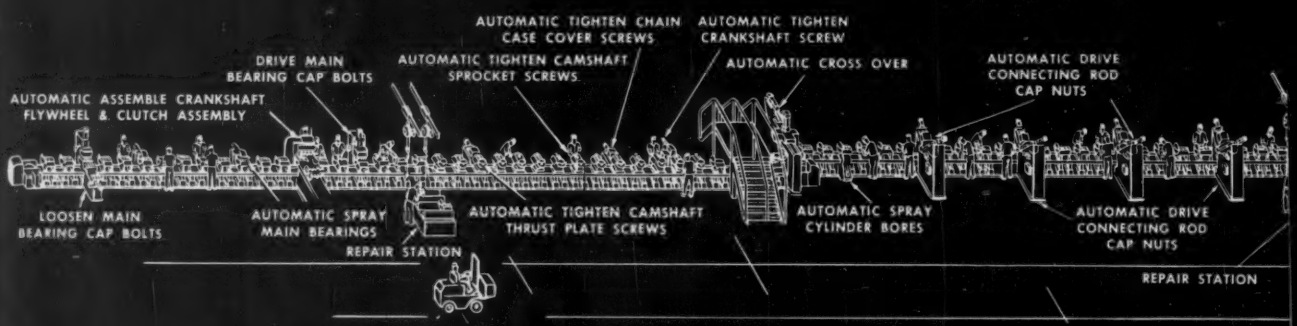
Address _____

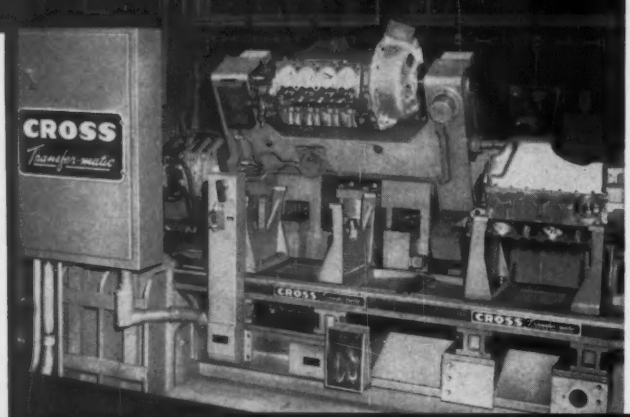
City, Zone, State _____

Another Automation First by Cross

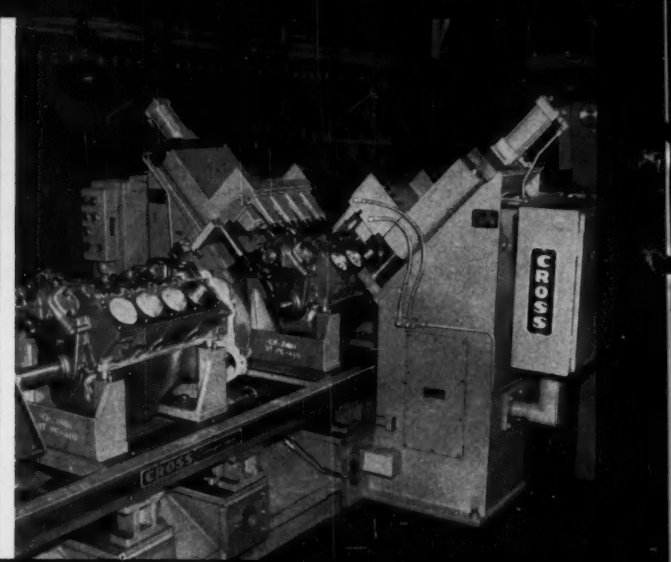
Automation for Car Engine Assembly!




AUTOMATIC ASSEMBLE CRANKSHAFT FLYWHEEL & CLUTCH ASSEMBLY
DRIVE MAIN BEARING CAP BOLTS
AUTOMATIC TIGHTEN CAMSHAFT SPROCKET SCREWS
AUTOMATIC TIGHTEN CHAIN CASE COVER SCREWS
AUTOMATIC TIGHTEN CRANKSHAFT SCREW
AUTOMATIC CROSS OVER
AUTOMATIC DRIVE CONNECTING ROD CAP NUTS
LOOSEN MAIN BEARING CAP BOLTS
AUTOMATIC SPRAY MAIN BEARINGS
REPAIR STATION
AUTOMATIC TIGHTEN CAMSHAFT THRUST PLATE SCREWS
AUTOMATIC SPRAY CYLINDER BORES
AUTOMATIC DRIVE CONNECTING ROD CAP NUTS
REPAIR STATION

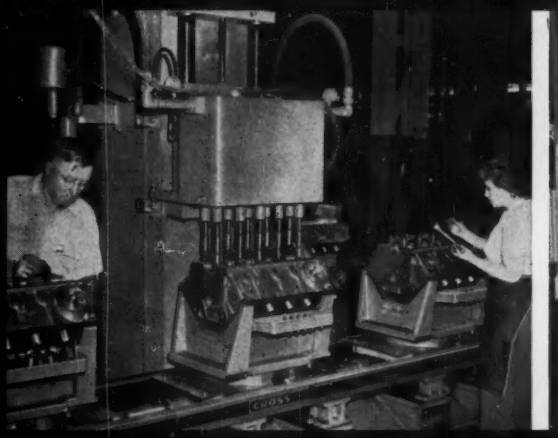


Section II, Station 44: engine is transferred to Section III, Station 1, and placed in car position.

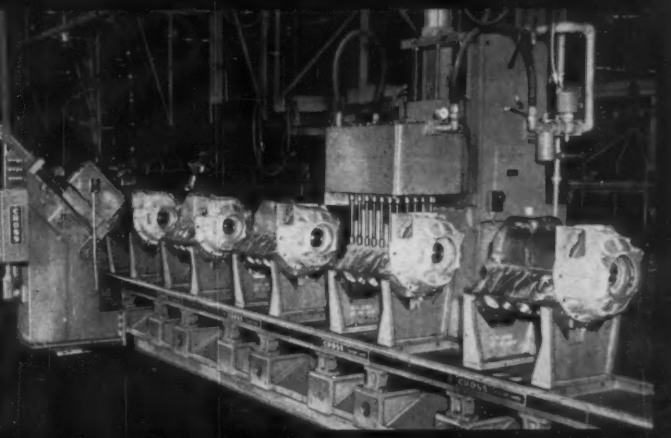


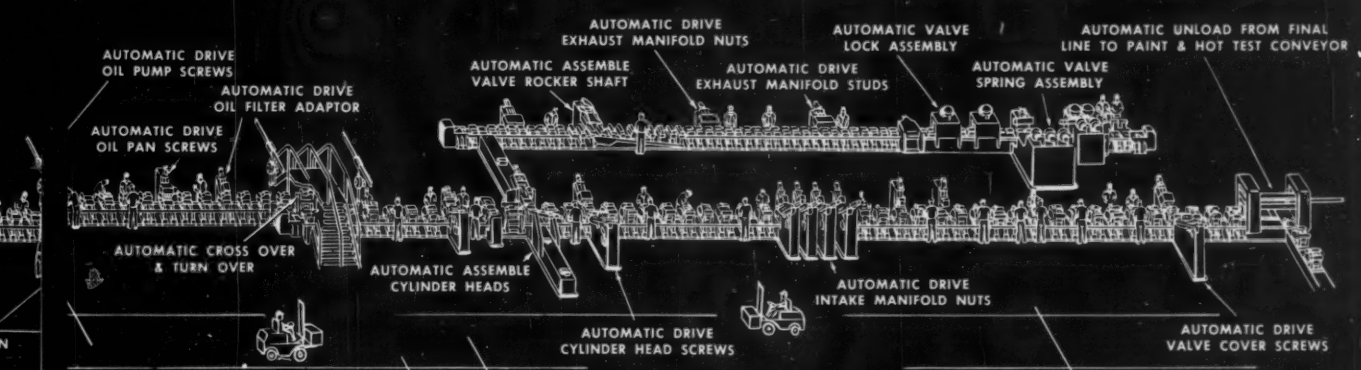
Section III, Station 3: oil is automatically applied to cylinders and valve lifter holes.

Section I, Station 3: bearing cap bolts are automatically loosened ready for crankshaft assembly.



Section II, Station 37: pan screws are automatically tightened, Station 40: oil filter adapter is assembled.




AUTOMATIC DRIVE OIL PUMP SCREWS
AUTOMATIC DRIVE OIL FILTER ADAPTOR
AUTOMATIC DRIVE OIL PAN SCREWS
AUTOMATIC CROSS OVER & TURN OVER
AUTOMATIC ASSEMBLE CYLINDER HEADS
AUTOMATIC DRIVE CYLINDER HEAD SCREWS
AUTOMATIC DRIVE EXHAUST MANIFOLD NUTS
AUTOMATIC ASSEMBLE VALVE ROCKER SHAFT
AUTOMATIC DRIVE EXHAUST MANIFOLD STUDS
AUTOMATIC DRIVE INTAKE MANIFOLD NUTS
AUTOMATIC VALVE LOCK ASSEMBLY
AUTOMATIC VALVE SPRING ASSEMBLY
AUTOMATIC UNLOAD FROM FINAL LINE TO PAINT & HOT TEST CONVEYOR
AUTOMATIC DRIVE VALVE COVER SCREWS

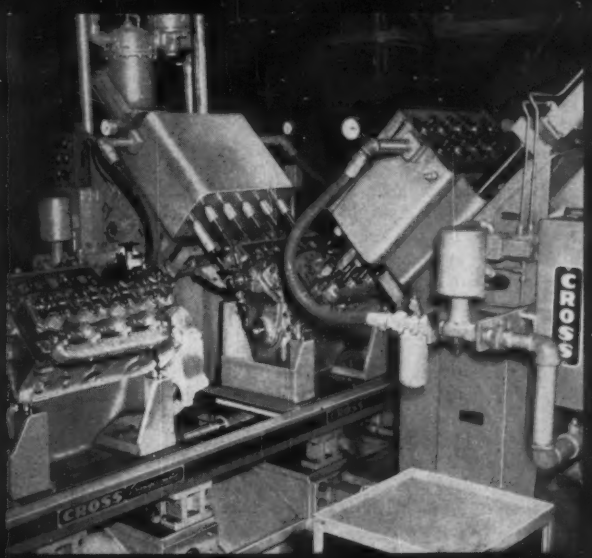
This production line for assembling V-8 car engines consists of three Transfer-matics with a total length of 812 feet. One assembles the engine; the other two (only one shown) assemble the cylinder heads. Operations start at three points with the block and head castings. They are automatically transferred through 198 stations as parts and sub-assemblies are added until the engine is completed and ready for testing.

The rated capacity is 150 engines per hour.

The engine assembly Transfer-matic is sectionized, a feature originated by Cross to reduce downtime. Three sections are provided to permit stopping some operations without interrupting the others.

Modular unit construction provides flexibility for engine changes and for adding new automatic assembly devices of the future.

Like other Cross machines, all parts—even tooling details—are made to interchangeable tolerances for fast, easy maintenance. Other features include construction to JIC standards and automatic lubrication.



Section III, Station 15: cylinder head bolts are tightened to a pre-determined torque.

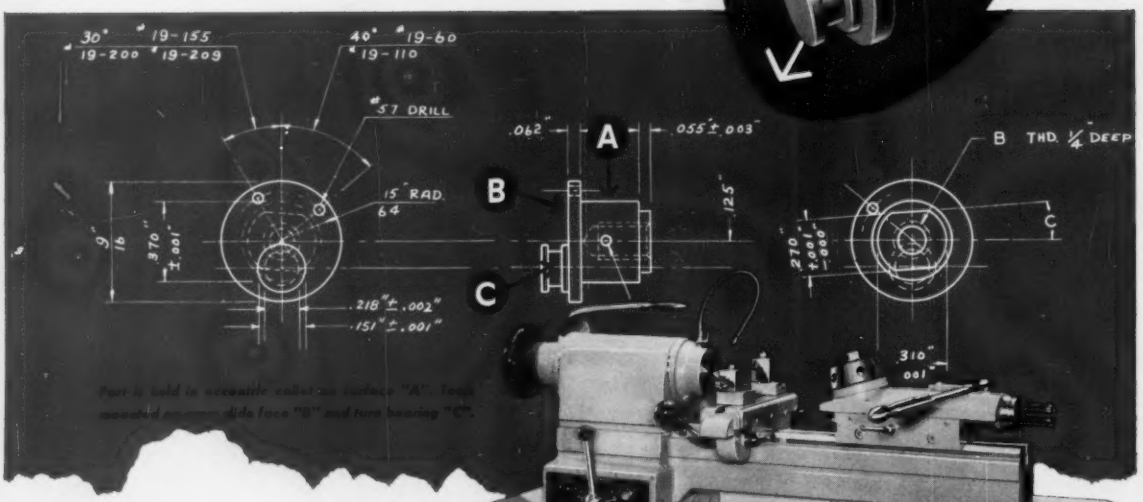
Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

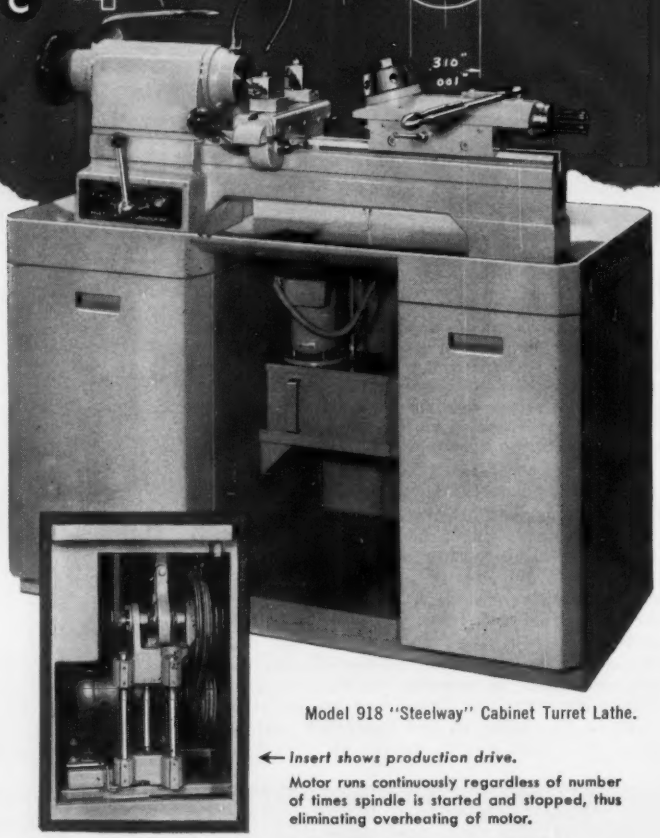
INSTANT start-stop boosts Penn Fishing Tackle parts to 250 per hour!



Penn Fishing Tackle Mfg. Co. practices what it preaches. Its officials went fishing recently —to catch some ideas for stepping up production on several eccentric parts. Investigation of the Rivett 918 "Steelway" Cabinet Turret Lathe revealed that machine with its production drive was ideally suited to their requirements.

This production drive features "split-second" starting and stopping of the lathe spindle by movement of the lever chuck closer handle. With one forward pull, the operator closes the collet on the work, releases the brake and engages the spindle drive. When the lever is pushed back, the spindle drive is disengaged, the brake mechanism is applied and the work is released.

Installation of the 918 "Steelway" turret proved immediately successful. Production of troublesome parts was boosted two-fold. A 918 "Steelway" can boost your production, too! Why not go fishing and see what savings can be caught!



Model 918 "Steelway" Cabinet Turret Lathe.

← *Insert shows production drive.*

Motor runs continuously regardless of number of times spindle is started and stopped, thus eliminating overheating of motor.

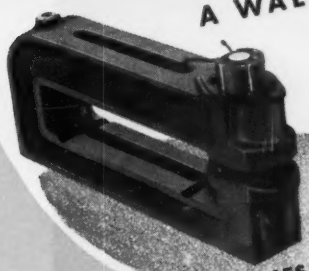
RIVETT LATHE & GRINDER, INC., DEPT. MR3, BRIGHTON 35, BOSTON, MASS.

For more information fill in page number on Inquiry Card, on page 255

Don't Waste Hours ADJUSTING AND SETTING CONVENTIONAL DIES

when the "WALES-WAY" takes ONLY MINUTES!

A WALES TOOL



TAKES MINUTES TO SET

AND ELIMINATES HOURS OF

- set-up time
- press down time
- setting stripping guides
- counter-boring for springs
- setting heavy stripper plates
- die buttons, etc. etc.

WALES MOBILE TRUCK UNITS

We have a well-equipped Motor Truck . . . a shop on wheels . . . that will demonstrate "WALES-WAY" methods right at your door. We will gladly arrange to have you see and use this demonstration. Please let us know a suitable time.

A Typical Foreman says:

"That's the way it's been around this shop for years. Still would be if the boss hadn't heard about WALES Hole Punching UNITS. What a deal.

"Instead of building a new die for each pattern, setting it in, lining it up and constantly checking to make sure punch and guide register, instead of watching the special punch plates, stripper plates, the press ram, watching the die buttons and all the rest of time cosuming detail . . .

". . . we do it the "WALES-WAY" *now*. We set up a group of these self contained, individual WALES UNITS, one group for each pattern. We do it *fast*; so fast that our first run is on the punch press the same day. We can set up in minutes, change in minutes, shove work through faster than ever before because of the automatic guide principle that keeps the run accurate to the hair line from first to last ram press stroke."

WALES UNITS may be used over and over again. No dead storage. No enormous files of dies, plates etc. to be combed over for a re-run. This wonderfully flexible method requires a minimum of equipment at a minimum of cost. Saves hours and hours in your shop. Makes plenty of additional profit on every run.

No die-set needed, no pressure pads, no stripper plates with WALES UNITS. Punches, stripping guides, springs and guide buttons are all component parts of the UNITS — not attached to the press ram. WALES UNITS have a shut height of 5½" so only one adjustment of the ram is needed.

WALES ENGINEERING SERVICE • Our Engineers will survey your shop, your work, your methods if you wish, entirely without obligation. You'll receive valuable information and suggestions for time saving and EXTRA PROFITS.

Send for
BULLETIN NO. 15A

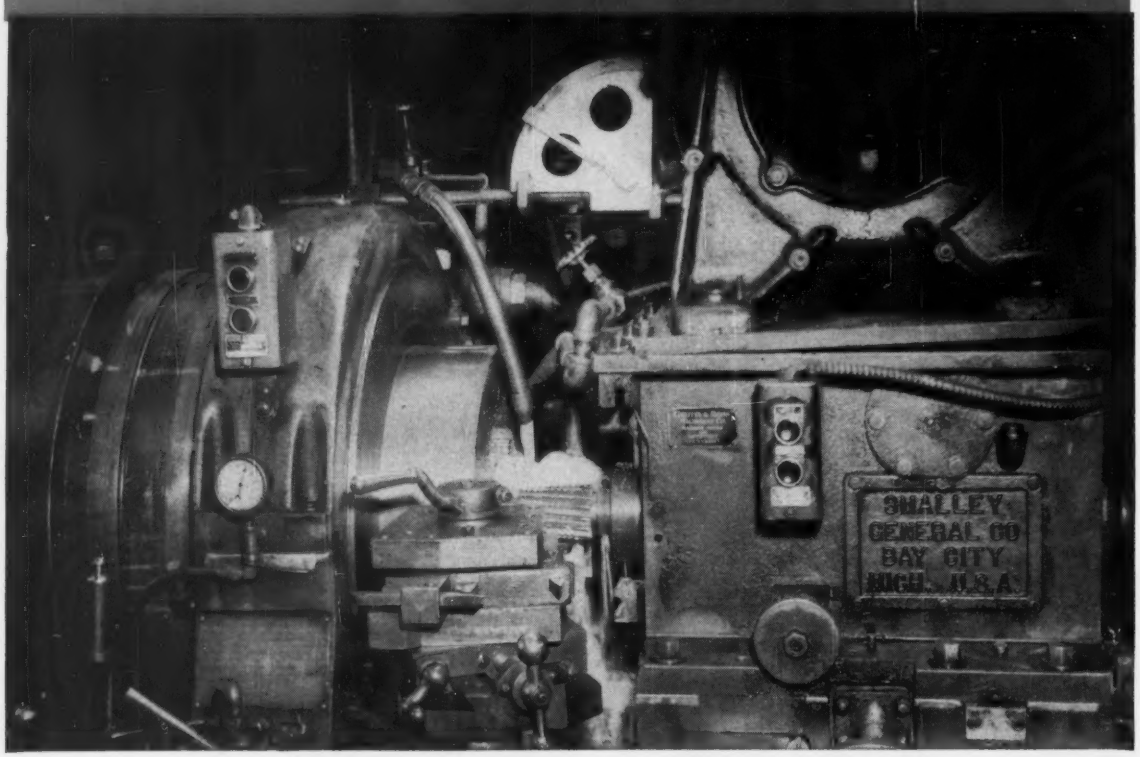
This folder contains much information that should interest you. Pictures and data to help you judge the merits of "the WALES-WAY"

WALES Strippit CORPORATION
"...the Wales-Way is the PLUS-PROFIT way"
345 PAYNE AVE. — North Tonawanda, N.Y.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

See Our Exhibit—Booth 379
Chicago, March 19-23

"TEXACO SOLUBLE OIL HAS SAVED US THOUSANDS OF DOLLARS"—says Pennsylvania company

(Name on Request)



THE JOB is milling a step thread. The coolant is a 1:20 emulsion of *Texaco Soluble Oil C*. Tool performance and finish are excellent, and there is *no rust*.

This ability of *Texaco Soluble Oil C* to prevent rust is particularly important here. At one time this company was forced to keep thousands of dollars worth of finished parts on open pallets for four and a half months in severe humidity. But, they report, "We can thank *Texaco Soluble Oil* for the fact that *we had no single case of rusting or indication of rust on the parts.*"

Whatever your metal working goal—rust prevention, increased tool life, better finish, greater production—there is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you achieve it. For hydraulic mechanisms, use *Texaco Regal Oil R&O*. It keeps systems free from sludge, rust and foam, assures smooth, uninterrupted operation.

A Texaco Lubrication Engineer will gladly help you do *all* your machining better, faster and at lower cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

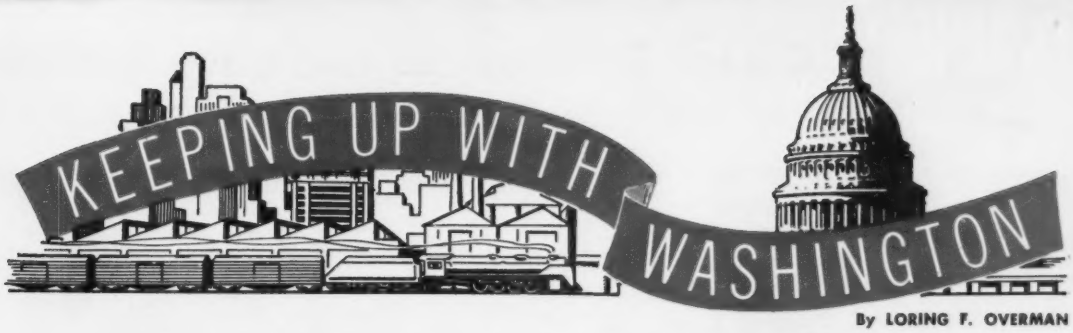
VISIT TEXACO BOOTH 1236, TOOL ENGINEERS' SHOW, CHICAGO, MARCH 19-23

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE on TV Sat. nights. METROPOLITAN OPERA radio broadcasts Sat. afternoons.

For more information fill in page number on Inquiry Card, on page 255



By LORING F. OVERMAN

Defense Department About-Faces in Machine Tool Procurement

NUCLEAR power plants! Intercontinental ballistic missiles! Atomic planes, cruisers, submarines, and aircraft carriers! Radar air-defense systems! Given all these new factors in the industrial and defense mechanism of a nation, it is small wonder that Washington seems to be having considerable difficulty keeping the machine tool industry in proper perspective.

About-Face

There have been two recent developments of direct interest to machine tool designers and producers. First, a complete about-face on the part of the Defense Department involves a major shift in emphasis away from the long-range lay-away of machine tools in favor of current use and constant modernization; second, an outgrowth of the first, was the scheduling of a late January Congressional investigation of the new policy.

$184,000,000 Not Spent

Whatever the final result, the machine tool program of the Office of Defense Mobilization and the Department of Defense now becomes extremely unusual in one important respect. Only $16,000,000 was expended in two years out of a total of $200,000,000 appropriated. The money was appropriated under the so-called Vance Plan, which restricted procurement of tools to mobilization requirements without making provision for current tool needs, replacement of obsolete equipment, procurement of more efficient units, or periodic review of requirements.

The new program provides that reserve machine tools be maintained in two ways: (1) by the individual military departments, in packages, to produce selected end items under mobilization, and (2) in a central Defense Department inventory, as individual tools available for current use. All tools are to be reviewed annually.

Scheduled to become effective "in the near future," the new program has three principal objectives: (1) to permit procurement of long lead-time tools, (2) to prevent obsolescence, and (3) to meet changing current military and mobilization reserve requirements. This policy also provides for current use of packaged tools, which may be borrowed from other services or from the central inventory to meet urgent production schedules when such equipment is not available. Borrowed equipment is to be returned to the packages, if required, when replacement tools become available.

Under the new directives, each military department will budget for its own tools, including those needed for current programs, mobilization reserves, and replacement. It is felt that this plan will enable the services "to take advantage of production savings from more efficient, newly developed equipment."

Machine Tool Sales May Rise

The new ODM policy, coupled with increased industrial demand for machine tools, may make 1956 a better year for the machine tool industry. Shipments in 1955 reached a four-year low of $660,000,000, according to Louis Polk, president of the National Machine Tool Builders' Association. Shipments in 1954 totalled $891,750,000, and in 1953, $1,191,200,000. Requirements of the Armed Services, now that they can buy for current needs as well as for inventory, may add materially to the 1956 total.

Atomic Influence

More and more decisions concerning defense are being based upon nuclear considerations. This may explain, to some extent, the shift in machine tool policy. There is still much uncertainty as to the types of weapons to be needed and, therefore, the types of machines required to make them. In speaking of research and development activities in his budget message, the President said, "Major emphasis will be placed on projects related to guided missiles, continental defense, and the application of nuclear energy to the propulsion of aircraft and ships."

Expenditures for the procurement of guided missiles will increase by one-third in the fiscal year 1957—to a total of $1,776,000,000. In addition, the Defense Department plans an expenditure of nearly one-quarter billion dollars on research in the field of guided missiles. Top priority goes to the study of an intercontinental ballistic missile intended to carry nuclear weapons to a target 1500 miles distant.

Recognizing that there are no likely targets within 1500 miles of our shores, the Navy is changing its specifications to anticipate the task of carrying missiles to within 1500 miles of "somewhere." Included in the Navy's requested budget for 1957 are provisions for a nuclear-powered guided-missile cruiser, six nuclear-powered submarines, five converted cruisers to carry guided missiles, and one nuclear-powered carrier of the Forrestal type, "as soon as a satisfactory power plant is developed."

Washington Briefs

Minerals—The Office of Minerals Mobilization is sending questionnaires to 35,000 companies in an effort to estimate amounts of steel, copper, and aluminum shapes and forms which would be needed for maintenance, repair, and operating supplies in case of a mobilization.

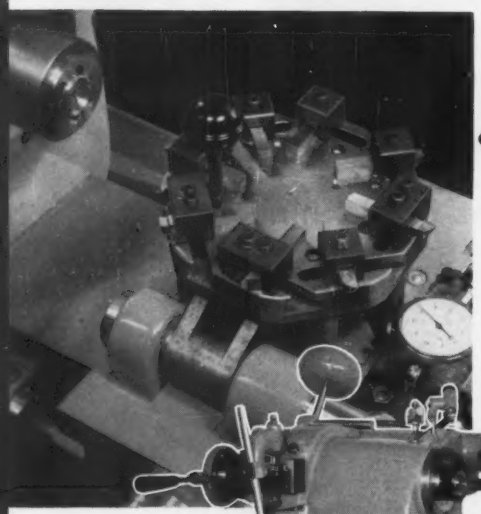
Negotiated Contracts — Congressional concern over the fact that some 90 per cent of all defense contracts are let on a negotiated basis instead of being advertised is not expected to change the practice materially. Because of the complex and often secret nature of the military item, advertising for bids is impracticable. Military spokesmen pointed out that the presence of negotiation does not mean the absence of competition. Negotiated contracts, they said, are usually completed only after preliminary conferences with several prospective suppliers.

Catalogue Conference—The final cataloguing conference, sponsored by the Defense Department and the National Security Industrial Association, was scheduled for January 26 in Washington. Indicative of the interest aroused was the fact that the conference was expected to fill the main Department of Labor auditorium, with representatives of all government purchasing agencies being present.

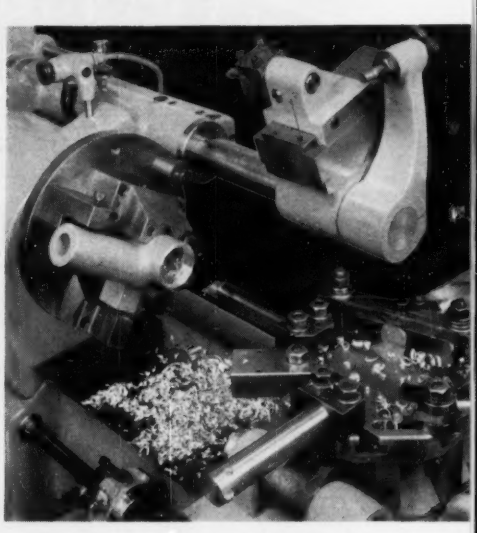
HARDINGE
ELMIRA, N.Y.

"Closer Tolerances Increase Demand

for the HARDINGE HCT Precision Chucking Machine"

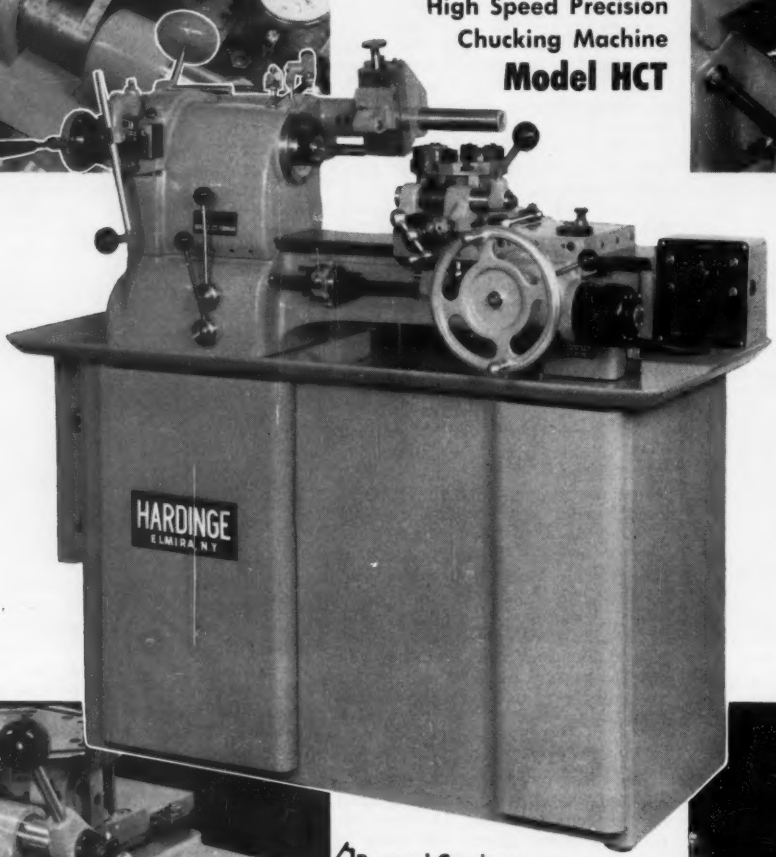


8-Station Turret

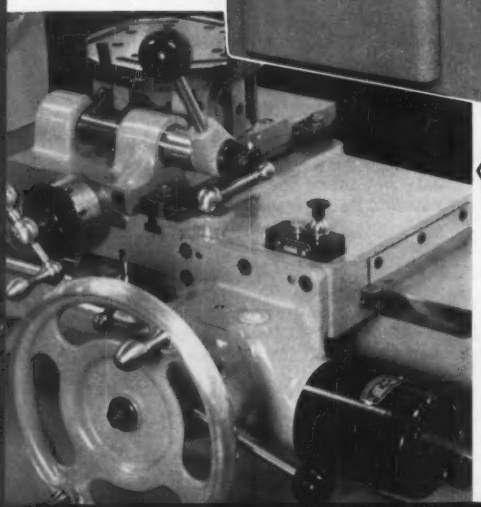


Flexible Range of Operation

High Speed Precision
Chucking Machine
Model HCT



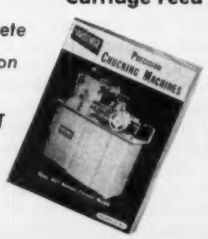
Hardinge Model HCT Precision Chucking Machine finishes diameters, recesses, shoulders, back faces, front faces, and cuts precision threads in *one setting – all concentric* with each other. Tooled inexpensively with standard tool bits.

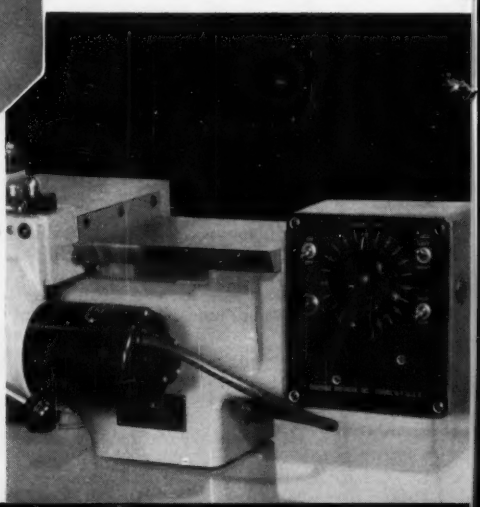


Rugged Carriage

Independent Variable
Carriage Feed

For complete information write for Bulletin HCT





HARDINGE BROTHERS, INC., ELMIRA, N. Y.

See **HARDINGE MACHINES IN ACTION – SPACE 452 – CHICAGO – A.S.T.E. SHOW**

MACHINERY
MARCH 1956

Tooling for Tomorrow—on Exhibit Today

THE industrial exhibition that has become a biennial tradition of the American Society of Tool Engineers will be held this month in Chicago. The 500 exhibitors are expected to disclose thousands of new products and production ideas for solving the daily problems of manufacturing executives.

Running concurrently with the exhibition will be an industrial conference at which technical papers will be presented by sixty executives and engineers who are experts on particular phases of tool engineering. Subjects to be discussed range from ceramic cutting tools and man-made diamonds for machining operations to such management problems as the economics of renting or buying machine tools and training tool engineers.

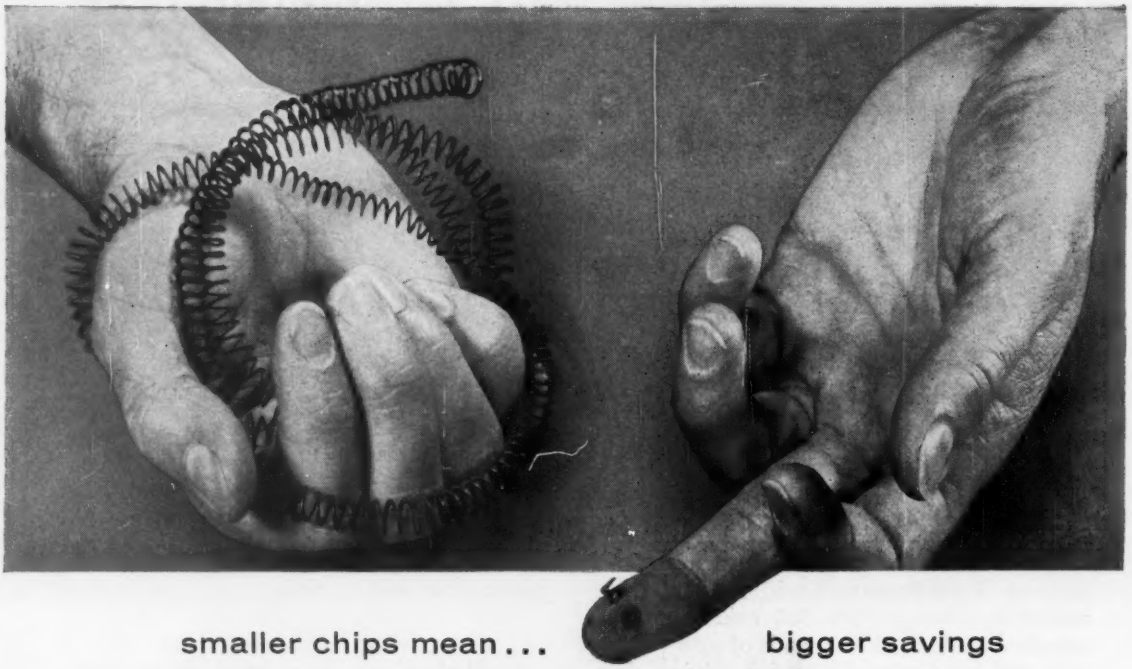
Attendance at these sessions should provide a liberal education in matters of paramount interest to tool engineers and industrial executives. Men who go to these sessions should be able to develop a sound basis for analyzing the value of new tooling concepts as these might apply to their own manufacturing programs. The need for greater knowledge along such lines cannot be emphasized too greatly in these days when operating costs rise constantly in line with our expanding national economy.

Population increases and a rising standard of living have produced such a heavy demand for consumer goods that the production equipment in numerous plants is inadequate to meet market requirements. Tool engineers and production men will be called upon to work up remedial measures. Their principal sources of education to prepare themselves for the work ahead consist of articles in the technical press, engineering books, and industrial exhibitions and conferences. These are the main facilities by which engineers can keep up with the technological developments and scientific advances that must be applied in the plants where they are employed if their concerns are to keep up with competition.

Today, the men responsible for manufacturing methods in any plant simply cannot afford to be complacent about the efficiency of methods that have been in use for some years. Is it any wonder that the Society anticipates an attendance at the coming exhibition of over 40,000 registrants?

Charles O. Herb

EDITOR



smaller chips mean... bigger savings

Cut costs with RYCUT steels!

Three new Ryerson leaded alloys

These short, fast-breaking chips have real meaning to cost-conscious purchasing and production men. In an ever-increasing number of shops, small chips like these mean that the switch has been made to Rycut steels. They mean that tools are turning faster—that production is up as much as 200%.

The secret of Rycut's machining speed is a minute quantity of lead, finely dispersed throughout the steel. This acts as a lubricant between tool and steel. The results are revolutionizing machine shop practice:

- Up to 200% more parts can be produced per machine hour!
- Tool life is lengthened as much as 300%!
- Finish is improved!

There's a Rycut leaded alloy for every application. Use RYCUT 20 when you need a carburizing alloy; RYCUT 40 for .40 carbon alloy applications; and RYCUT 50 for .50 carbon alloy uses. Every one is a cost-cutter.

Figure how much this increased production and longer tool life would lower costs in YOUR shop—and raise your profits! Call your nearby Ryerson plant today . . . large stocks assure you of quick shipment.

LEADED PLATE VS. MILD STEEL A MACHINING DEMONSTRATION— BOOTH 1400 ASTE SHOW

The remarkable machinability of our New E-Z-Cut leaded plate steel will be demonstrated at the March ASTE Show in Chicago. Don't miss it.

Flame cutting also demonstrated—Watch the actual burning of intricate steel shapes with electric eye equipment.

RYERSON STEEL

In stock: Bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing bars, machinery & tools, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

For more information fill in page number on Inquiry Card, on page 255

Photo by
Louis C. Williams

TOOLING FOR TOMORROW

According to all indications, the Tooling for Tomorrow Exposition to be held by the American Society of Tool Engineers in the Chicago Amphitheatre, March 19 to 23, will be the largest in the history of that organization. This issue of MACHINERY previews some of the manufacturing and inspection equipment that will be introduced to Show visitors and features articles of prime interest to tool designers and users. Designing progressive dies, tapping titanium, calibrating gage-blocks, producing accurate holes, and an automated stamping installation are some of the subjects covered.

Vol. 62 No. 7 MACHINERY March, 1956

Automation Facts—Not Fancies

THERE certainly have been enough wild stories about automation floating around the country of late—how it would throw millions out of work—how it would wind up by wrecking our economy—how it would put everybody except the biggest companies out of business—how it would make the worker a slave of the machine instead of the machine being his "tool."

Some time ago the American Society of Tool Engineers decided to take the measure of automation in the metal-working industries—what its potential impact might be, where it could be expected to occur, and what major effects might be expected from it.

That study, as far as it could go, is now complete, and some of the answers are as fascinating to the industrially minded as the rampant, wild theories of yesterday were to the demagogues. Let's take a look at a few of them:

How much of industry can we expect to automate eventually?—25 per cent, 50 per cent, 75 per cent?

Industry's answer is 16 per cent. Of all manufacturing operations in the metal-working industries, 16 per cent are considered potentially automatable. That includes machining, metal forming, materials handling, inspection, welding, and assembling. It certainly doesn't sound as if THAT much automation would upset the economy of the country.

But wait a minute, let's take a look at what that 16 per cent would mean from the standpoint of re-tooling. Here, fortunately, the ASTE identified what proportion of operations would require completely new equipment and what proportion could be automated by applying loading and unloading devices and automatic controls to existing machinery. So, we are able to isolate to a considerable extent the equipment that would have to be scrapped or otherwise disposed of. Here are some approximate figures for the metal-working industries:

Over 255,000 machine tools, including grinding and finishing machines;
Close to 50,000 metal-forming machines;
Approximately 25,000 production welders of various types.

To that would have to be added proportionate amounts of related production equipment. All this equipment will have to be completely replaced with automated machinery. How much will it cost? Six to seven billion dollars shouldn't be too high a figure!

But to that you also have to add loading and unloading equipment and control mechanisms for something like this:

150,000 machine tools;
40,000 metal-forming machines;
12,000 production welders—plus proportionate amounts of related equipment.

By the time you get through adding it up, it doesn't look as if there was going to be much left out of $10,000,000,000!

But, again, that isn't the end of the story. The ASTE study clearly shows that the advent of more complete automation is bringing with it a complete revision in concept as to optimum economic plant sizes. It isn't the great big plant for complex assemblies that will be most highly automated, the study shows. As a matter of fact, the all-under-one-roof concept is definitely opposed to what is best for automation. Some concerns are going to need new plants—smaller ones.

The best field for automation apparently is the medium-sized plant, the plant that makes a few simple things, such as pots and pans, toys, pipe and pipe fittings, etc. The automotive industry? Certainly, there will be more automation in that industry. It is doing more in that respect right now than any other. But that automation is going into the processing of engines, the manufacture of transmissions, the production of axles, and other sub-assemblies and their components.

Why? Because these sub-assemblies can be ex-

By
Dr. H. B. OSBORN, Jr., President
American Society of Tool Engineers

pected to stay put reasonably well for a while. No one in the automobile industry is so far behind as to want to freeze the design of a car like Ford did with the old Model T. That's the fastest road to economic suicide! So what will be tentatively frozen—and that only within generous limits—are some of the sub-assemblies which go into automobiles. You can freeze basic engine design pretty well for quite a while. If you want more power next year, you put a little bit bigger throw on the crankshaft, or you ream out the cylinder bore, or you boost the valve sizes, or you shave a little bit more off the cylinder head to increase the compression ratio.

There you are. With a minimum of three or four major increases in power for three or four annual models, you haven't changed the basic design of the engine one bit. From a manfacturing standpoint, as far as the basic automation problems are concerned, that engine is "standardized." The user won't know it. To him it can't be the same engine, since in 1956 it delivers 135 H.P. and in 1960 will give 185 H.P., or better.

How to apply that new concept of "standards"—the standardization, not of specific values, but of a range of values—is something that we are learning from automation. Automation costs too much to scrap every year, so we apply it to the things that change least, allow for as many changes as we can, and then try to design the manufacturing equipment so that it, too, can be changed without scrapping everything.

Well, how fast are we moving toward 16 per cent automation? That varies by industry. Is the movement accelerating? With almost no exception, 1957 will show an increase over 1956. As a matter of fact, the correlation between industries in this regard is so amazing that it almost seems as if all the metal-working industries had gotten together and agreed to expand automation activities in 1957.

Probably the best way to judge the rapidity with which automation is coming is by the proportion of the new-production-equipment dollar which is going to be spent for automated equipment. The ASTE average for all industry is 18 per cent of total expenditures for 1956, and 22 per cent for 1957. By industries, it looks something like this:

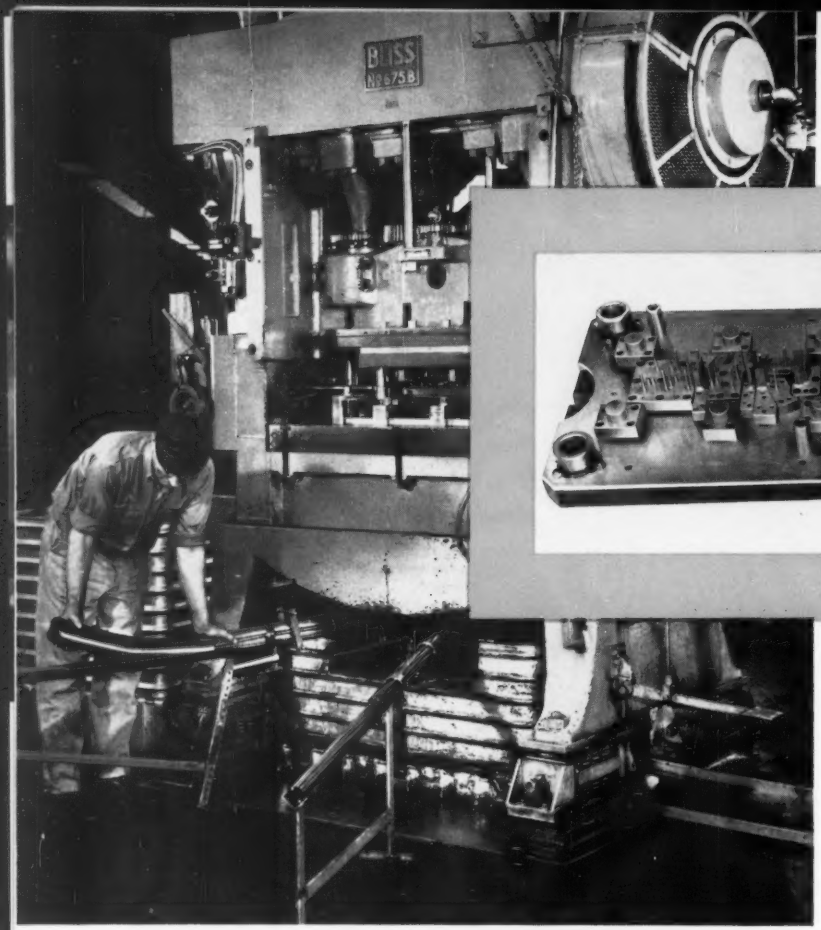
	1956 (Per Cent)	1956-57 (Per Cent)
Automotive, including parts	28	35
Fabricated metal products in general	21	25
Aircraft, including components	18	21
Electrical, including appliances	14	18
Other transportation equipment	10	18
Heating, ventilating, refrigeration	10	15
Precision equipment, instruments	10	15
Machinery in general	8	11

Of course that does not give an accurate idea of the actual market, since it does not tell how many dollars.

We can get a bit closer to that by taking a look at the estimates of potential automation in the various industries and the amount of equipment that would either have to be scrapped or revamped—scrapped more often than not.

	Maximum Automation Potential (Per Cent)	Approximate Items of Major Production Equipment Involved
Fabricated metal products	17	144,000
Electrical, including appliances	16	75,000
Automotive	20	65,000
Machinery	7	40,000
Aircraft, including components	18	30,000
Precision equipment	19	28,000

(Continued on page 167)



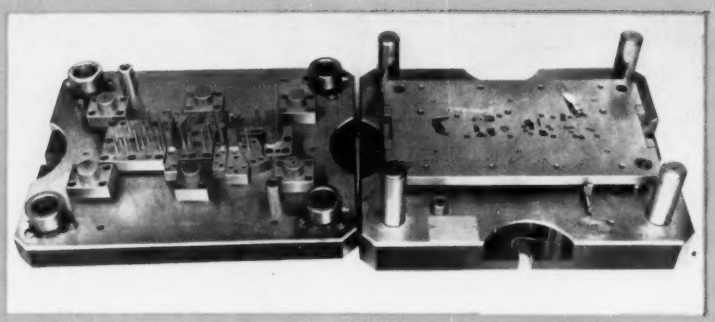


Photo above, courtesy of Jade Tool & Die Co.
Photo below, courtesy of E. W. Bliss Co.

LARGE quantities of accurately formed, interchangeable sheet-metal components can be produced rapidly, and therefore economically, by using properly designed progressive dies. Diversified in their potential applications, these progressive, or follow, dies can be constructed to perform many assembly type operations in addition to their more conventionally associated functions, such as piercing, notching, blanking, drawing, forming, extruding, embossing, and coining.

Developed Length

Before any progressive die can be designed, a careful study of the work-piece drawing must be made. Parts to be formed or bent must first be developed, or unfolded, to arrive at their true dimensions. The blank length of a part can be obtained by adding the combined length of all its straight legs, measured between the points of deformation, to the sum of the developed lengths of all bends.

Illustrated at B in Fig. 1 is an example of a simple sheet-metal bend. The developed length X of the material required to form the bend itself can be calculated by applying the following formula:

$$X = \frac{A\ \pi\ (R + kT)}{180}$$

in which

X = developed stock length for bend;
A = included bend angle in degrees;
R = inside bend radius;
T = thickness of sheet metal;
k = constant, denoting the location of neutral bending line from inside radius. For most purposes, it can be taken as 1/3.

For cases involving a right-angle, or 90-degree, bend, the following formula can be used:

$$X = 1.5708\ (R + kT)$$

Listed in Table 1 are the developed length values for 90-degree bends in sheet metal of various thicknesses and inside bend radii. With bends other than those of 90 degrees, the developed length is directly proportional to the included angle.

Designing Progressive Dies

Sheet-metal parts of either simple or complex configurations can be completed in a single pass through carefully designed and constructed progressive dies. This article deals with some important features of these press-room tools. First of two installments

By H. C. TSIEN, President
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Many parts are designed with an offset that is formed by the blending of two equal radii. A typical bend of this type is illustrated at C in Fig. 1. To determine the true length of the part, it is necessary to find the developed length of horizontal distance H, or the developed stock length for the combined bend. This can be done by applying the formula:

$$X = \frac{A\ \pi\ (R + kT)}{90}$$

The designations used are identical with those employed in the first formula.

Should it be necessary to find dimension H, the following formula can be used:

$$H = \sqrt{Z\ (4R + 2T - Z)}$$

in which

Z = offset of work-piece;
R = radius of one bend (both bends being of equal radius);
T = thickness of sheet metal.

The preceding formulas should be applied only if $(2R + T)$ is no larger than offset Z.

If angle A is not given, it can be calculated by employing the formula:

$$\text{Cos } A = \frac{2R + T - Z}{2R + T}$$

Calculated developed lengths are not exact, and should be used only as a guide. Actual developed lengths, in cases where accuracy is important, should be worked out by the diemaker on material of the same composition and thickness as that specified to be used for the finished sheet-metal part.

Scrap-Strip Lay-Out

The lay-out of the scrap strip has a direct bearing not only on the unit cost of the components produced, but also on the design features of the die to be constructed. Basic arrangement of the metal-working members of the die is determined by the positioning of the work-piece blank on the strip. To simplify this lay-out, which is often a time-consuming task, several developed blanks can be cut from a material such as thin plastic or tracing paper. They may then be ad-

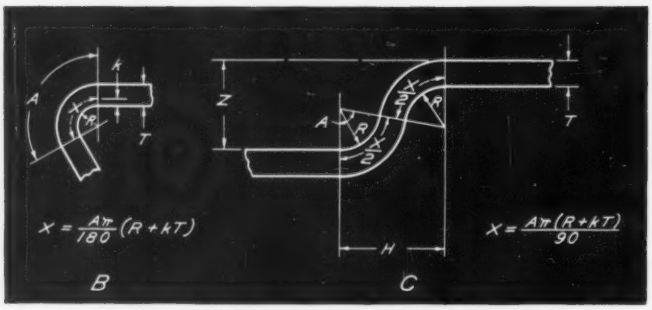


Fig. 1. Basic formula used to calculate developed length of sheet-metal bend, view B. Typical offset formation and formula, view C, for calculating the developed length of horizontal distance (H), where (2R + T) is no larger than distance (Z).

justed and re-adjusted until a suitable arrangement of the blanks is reached.

In the interest of stock economy, the part is frequently laid out on the strip at an angle. If the parts are to be formed, they should be placed so that the bend falls across the material grain or, if necessary, at an angle preferably not less than 45 degrees from the grain line. Bends in thin material, especially those formed with a small radius, that are made any closer to the direction of the grain running through the strip are apt to result in fracture of the outer bend radius. This occurs more frequently on material of thicker cross-section.

Standardization of stock sizes is a desirable policy, and one that is practiced by a great many companies. The die designer can adhere to such a policy by making sure that the width of the scrap strip required is a standard size (1, 1 1/2, 2, 2 1/2 inches or wider in 1/2-inch increments). Waste material lying between the extremities of the blank and the edges of the scrap strip should be held to a minimum width equal to the thickness of the strip, but not less than 1/16 inch. An exception to this is the lay-out in which the blank and the scrap strip are the same width. In this case no scrap frame passes out of the die.

Two small components of opposite hands, shown at X in Fig. 2, are to be formed from 0.040-inch thick strips of low-carbon steel. The only difference between these two members is the direction in which the ear is bent, being up for the left-hand part and down for the right-hand part. These two work-pieces will serve as examples of how the scrap-strip lay-out guides the development of a progressive die.

Each of the two parts in question has a half-moon shaped hole *A*, a hole *B* with two keyways, an extruded hole *C*, and a bent ear *D*. Because of functional requirements, contour *E* requires a shaving operation.

After developing the blank, which, in this case, merely requires unfolding of the ear, the lay-out of the scrap strip is made. The lay-out

Table 1. Lengths of Straight Stock Required for 90-Degree Bends*

Radius *R* of Bend, Inch	Thickness *T* of Material, Inch												
	0.010	0.015	0.020	0.025	0.031	0.040	0.045	0.050	0.0625	0.072	0.083	0.094	0.125
0.000	0.005	0.008	0.010	0.013	0.016	0.021	0.024	0.026	0.033	0.038	0.044	0.049	0.066
0.005	0.013	0.016	0.018	0.021	0.024	0.029	0.031	0.034	0.041	0.046	0.051	0.057	0.073
0.010	0.021	0.024	0.026	0.029	0.032	0.037	0.039	0.042	0.048	0.053	0.059	0.065	0.081
0.0156	0.030	0.032	0.035	0.038	0.041	0.045	0.048	0.051	0.057	0.062	0.068	0.074	0.090
0.020	0.037	0.039	0.042	0.044	0.048	0.052	0.055	0.058	0.064	0.069	0.075	0.081	0.097
0.031	0.054	0.057	0.060	0.062	0.065	0.070	0.072	0.075	0.082	0.087	0.093	0.098	0.115
0.0625	0.103	0.106	0.109	0.111	0.114	0.119	0.122	0.124	0.131	0.136	0.142	0.147	0.164
0.0937	0.152	0.155	0.158	0.160	0.163	0.168	0.171	0.173	0.180	0.185	0.191	0.196	0.213
0.125	0.202	0.204	0.207	0.209	0.213	0.217	0.220	0.223	0.228	0.234	0.240	0.246	0.262
0.1875	0.300	0.302	0.305	0.308	0.311	0.316	0.318	0.321	0.327	0.332	0.338	0.344	0.360
0.250	0.398	0.401	0.403	0.406	0.409	0.414	0.416	0.419	0.425	0.431	0.436	0.442	0.458

*Values based on the neutral bend line being ½ the metal thickness.

for the left-hand part is shown at Y in Fig. 2. From this lay-out the sequence of piercing, notching, shaving, extruding, blanking, and forming steps is planned. A finger-stop, or starting stop as it is sometimes referred to, is placed at the first station to arrest each new strip as it enters the die and to provide initial registering of the material with the first tool. In this station, two 1/4-inch diameter pilot holes are pierced in the scrap space, and the small hole *C* is pierced under size.

Contour *E* is notched in the second station, 0.005 inch of metal being left for subsequent shaving. In the third station, holes *A* and *B* are pierced, while in the fourth station, contour *E* is shaved to size. It can be seen in the illustration that the die sections which control the shaved contour are machined to a dovetail shape. This was done to prevent any shifting of the sections during the shaving operation. The contour around ear *D* is notched out in the fifth station, and in the sixth station, hole *C* is extruded. Since the material is extruded in a downward direction —producing the boss on the lower side of the part—this operation is usually the deciding factor in determining which side of the part should be the die side.

Up to and including the sixth station, the scrap-strip lay-outs for both the left- and right-hand parts are identical. For the left-hand part, the seventh station is left empty to allow more room for the eighth, or last, station. Because hole *C* has been extruded, a clearance hole must be provided in the empty station. In the last station, the ear is formed up, and the outside contour is blanked out. It is important to design the blanking punch so that previously shaved or notched contours are not touched. To assure complete blending of the contours, however, the cutting edge of the blanking punch should overlap the area already notched by approximately 1/32 inch.

A pressure-pad mounted on the punch-holder in the seventh station forms the ear down on the right-hand part, as shown at Z. The eighth station in this die remains empty to provide addi-

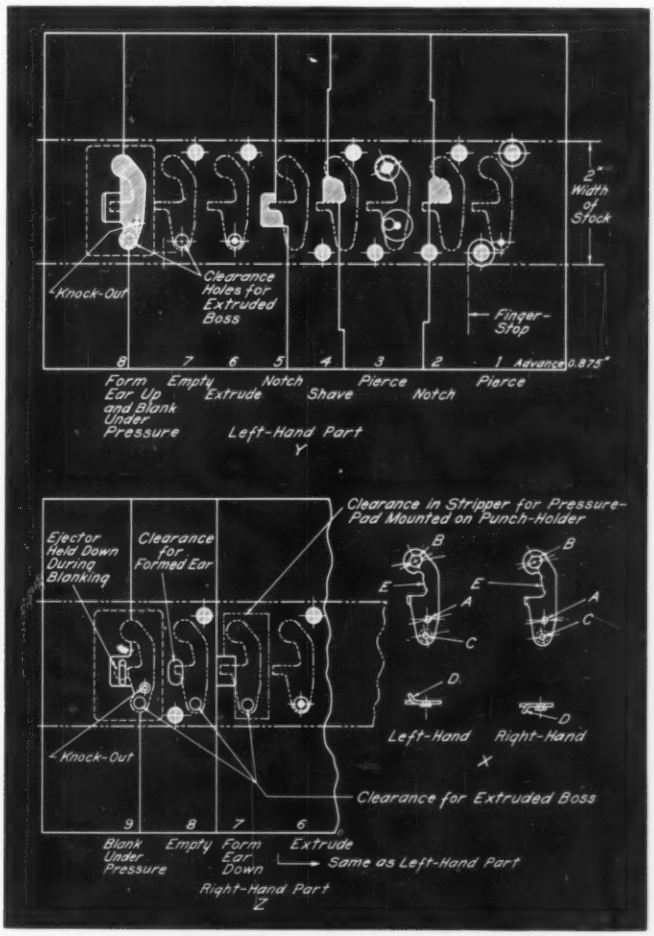


Fig. 2. Scrap-strip lay-outs for two similar parts of opposite hands. Progressive dies for producing these parts are developed from the lay-outs.

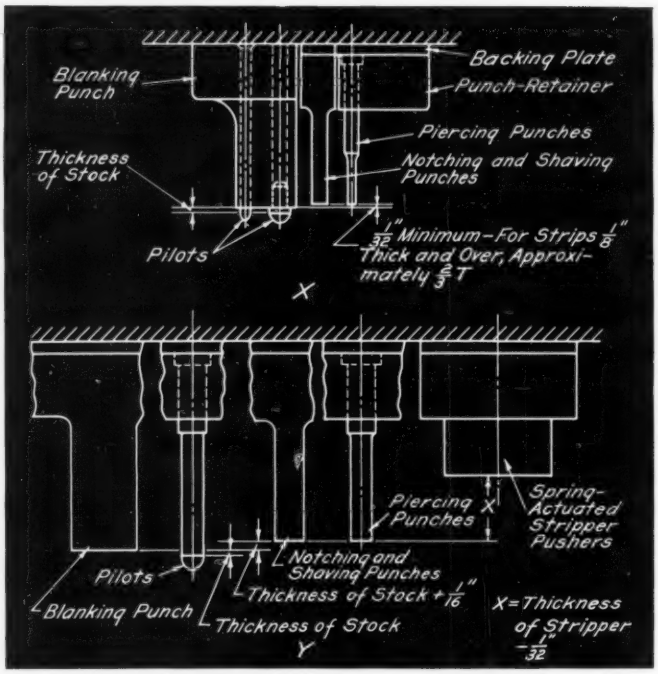
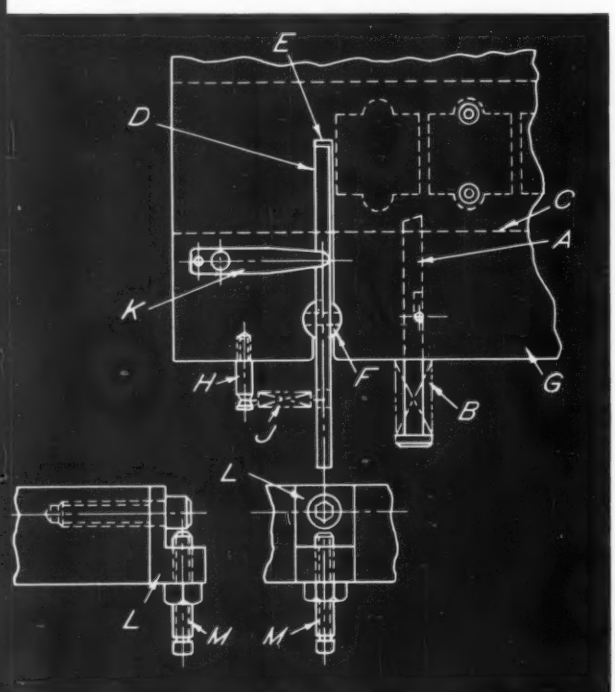


Fig. 3. (Right) Relative heights of piercing and blanking punches and pilots for use with fixed stripper, view X, and floating stripper, view Y.

Fig. 4. (Below) Finger-stop (A) and automatic stop (D) are commercially obtainable. Stops such as these are usually furnished as a set. Adjustable screw (M) travels with the punch-holder to trip the automatic stop.

tional room for the final operation. Clearance holes are provided in the empty station to accommodate the formed ear and the extruded boss. In the last station, the formed ear is first clamped down by a forked pin fitted in the blanking punch, and the work-piece is then blanked to size. Compressed air is used to eject the parts to the rear of the press. A floating stripper is preferable for both dies because of the need for a pressure-pad at the forming station, and also because flatness requirements call for punching and blanking under pressure.



Some Construction Features of Progressive Dies

Withdrawing of punches from sheet stock on the up stroke of the press results in the scrap strip being carried with the tool. This, of course, must be prevented. A simple method of stripping the stock from the punch makes use of a plate that is secured to the die member and contains openings for the punches to pass through. A passageway, or stock guide, is located beneath this stripper plate to facilitate movement of the scrap strip. The height of the stock-guide slots in the fixed stripper should be at least one and one-half times the stock thickness. Relative heights of piercing and blanking punches and pilots for fixed stripper set-ups are illustrated at X in Fig. 3.

Floating strippers are preferred whenever the parts must be maintained in a flat condition or when the finished part must be ejected from the side of the die. In this arrangement, the stripper plate is anchored to the die-holder by means of stripper bolts. The plate is held in an extended position by four or more compression springs, usually one in each corner.

There are at least four spring-actuated pushers mounted on the punch-holder. On the down stroke of the press ram, these pushers force the stripper plate into contact with the scrap strip, flattening it firmly against the die-block. The plate remains in this position until the punches have completed their work and have been withdrawn from the strip. At Y can be seen the relative heights of piercing and blanking punches and pilots for floating stripper arrangements.

Various forms of stops for controlling the position of the scrap strip are employed, especially on dies to be used without the advantages of an automatic feed mechanism. Many of these stops are available commercially and can be adapted for almost all kinds of progressive-die work.

In Fig. 4 are shown a commonly used finger-stop and an automatic stop that are usually furnished as a set. Finger-stop *A* is used to position a new strip of material for the initial operation. By applying finger pressure to the head of the stop, it will move in, against spring *B*, until it protrudes into guide way *C*. The stock is then butted against the stop, after which finger pressure is removed, permitting the stop to retract under the influence of spring *B*.

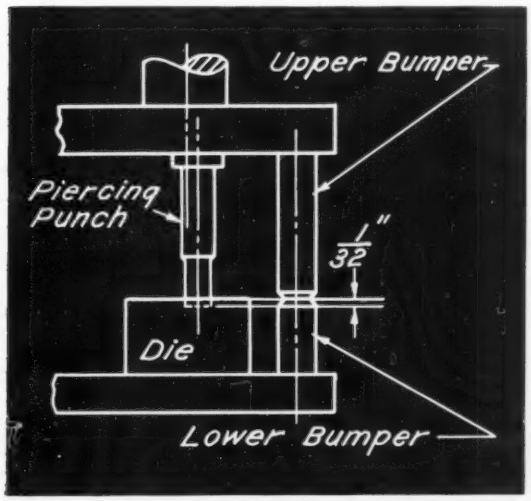


***Fig. 5.** (Above) Safety bumper-pins should allow the piercing punch to enter the die a maximum distance of 1/32 inch.*

***Fig. 6.** (Right) Stock lifters, view X, and stock equalizers, view Y, are intended for use with floating strippers.*

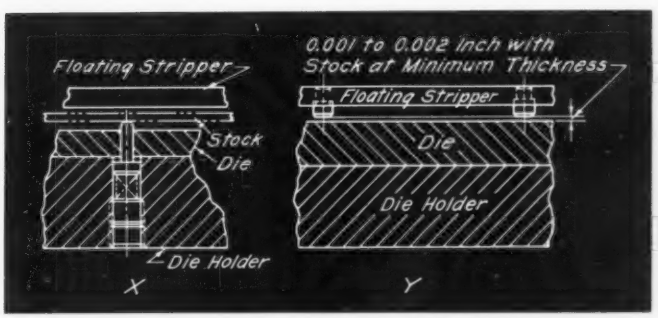
Automatic die stop *D* is made of oil-hardening tool steel. The end of the stop that contacts the scrap strip is either bent or milled to the desired shape and then hardened. Stripper plate *G* has a slot *E* and a hole *F* to accommodate the stop body and a pivot button, respectively. Pin *H*, tension spring *J*, and leaf spring *K* tend to keep the end of the stop down and to the right.

A bracket *L* is screwed to the punch-holder in line with the outer end of stop *D*. Adjusting screw *M* is set so that it will disengage the stop from the scrap strip at the proper time and allow the bridge of metal between the successive openings in the strip to pass.

Safety bumpers, or bumper-pins, serve a useful purpose. They aid in setting up the die because they are positioned to contact each other at the correct shut height of the tool. Conventional practice is to grind the bumpers on the die half of the tool so that they are flush with the die-block. The bumpers on the punch half of the tool are ground to such a height as to allow the piercing punches to enter the die a maximum distance of 1/32 inch. Suggested heights of the bumpers are shown in Fig. 5.

When a floating stripper is used or when the scrap strip must travel a considerable distance to reach the end of the die stations, it is advisable to provide stock lifters. These spring-loaded shoulder-pins are retained in the die, as shown at X, Fig. 6, and function to eliminate buckling of the stock when the stripper is in the raised position. Sometimes, owing to the design of a die, the stripper is apt to tilt because of uneven pressure along its surface. In such cases, it may be necessary to furnish stock equalizers similar to those shown at Y. They are hardened and ground shoulder-pins pressed into the lower surface of the stripper, and are so positioned as to give 0.001- to 0.002-inch clearance between the stripper and the die at minimum stock thickness.

Typical operations performed in progressive dies, a superimposition method of die lay-out, and some general considerations in designing progressive dies will be brought out in the concluding installment of this article.



Improving Performance of High-Speed Steel Tools

Best performance, long life, and reduced costs are realized in the use of high-speed steel cutting tools when the type of steel and the manufacturing and heat-treating methods employed in their production are closely supervised

By F. J. POHLMEYER, Chief Metallurgist
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OBTAINING maximum performance and life from modern high-speed steel cutting tools involves more than just having the right design and the proper application. Experience has shown that even the best designed and applied tool will not give top performance if three other important factors are overlooked. These factors are: grade selection, tool manufacturing process, and heat-treatment of the tool.

The selection of the grade of steel is under the combined control of the tool engineer and metallurgist. However, it is the tool manufacturer who carries the burden of responsibility for the other two critical factors: tool manufacturing and heat-treatment. The selection of the grade of high-speed steel is often a result of the tool manufacturer's recommendations, since this choice has a direct effect on his ability to economically produce tools that will be of a consistently high quality.

Selection of High-Speed Steel Tool Grades

High-speed steel grades for cutting tools are selected on the basis of five physical properties. These are:

1. *Abrasion resistance*—The ability to resist galling and pick-up.
2. *Edge toughness*—The ability to hold an edge and avoid break-off.
3. *Red hardness*—The hardness of the tool at elevated temperatures.
4. *Grindability*—The ability of a tool to be ground to size economically.
5. *Heat-treatment characteristics*—How the material responds to heat-treating, straightening, and special treatments without checking.

When a tool has good abrasion resistance, it may be slightly brittle. It will, however, have uniform carbide distribution and high resistance to pick-up of metal. Edge toughness is provided by a hard material that has proper grain size and flow. Excessive hardness or brittleness in a material can reduce edge toughness.

Red hardness is usually not a problem in tools such as high-speed steel broaches, because they are seldom pulled at speeds that will bring the tool material up to a high temperature. As far as grindability is concerned, there are many high-speed steels that will stand up about the same as other steels in use, yet can be ground more easily and with less wheel breakdown. Some tools, because of their size and shape, can be heat-treated with less danger of cracking or checking. There are also grades that will take special wear-resistant surface treatments better than others.

To obtain the desired physical characteristics in high-speed steel cutting tools, grades are available which have varying chemical analyses. To provide maximum beneficial effects, these various grades must be free from metallic inclu-

sions, have minimum carbide aggregations, be free from porosity, and have proper grain size and flow. Summarized, this means that each grade must have a homogeneous structure with a uniform distribution of carbide-forming elements. Heat-treating failures can occur in high-speed steel tools having too much carbide segregation in their centers.

No single grade of high-speed steel is best for all of the desired characteristics. The choice of material depends on the amount of precision desired, production volume, type of operation, whether the cut is intermittent or continuous, the cutting speed, feed rate, and type of material being machined.

Listed in the accompanying table are comparative ratings of molybdenum and tungsten type grades of modern high-speed steels for various physical properties. Typical applications and approximate cost comparisons are also given.

All of the high-speed steels shown in this table, as well as the majority of other tool steels available, can have their abrasion resistance and machinability factors improved by the addition of carefully controlled, small amounts of sulphur. A certain degree of sound judgment is required in the selection of grades of high-speed tool steels. Often, this choice must be a compromise between cost and performance.

Choice of High-Speed Steel Grades for Broaches

Four types of high-speed steel are in general use as quality broach materials. These include M-2, M-3, T-1, and T-2. The M-2 grade is lower in cost than the other three, has very good edge toughness, and good abrasion resistance. It is, however, more critical as far as heat-treatment is concerned, and more difficult to grind than T-1, as can be seen in the table.

The T-1 grade, having better grindability than M-2, is more suitable from the standpoint of manufacturing involute helical broaches; M-2 and M-3 grades of high-speed steel are more susceptible to decarburization than the other two grades mentioned and have more critical heat-treating temperatures. When a broach tooth has a high face angle and a large amount of back-

Various Grades of High-Speed Steel and Their Tool Applications

	Grade	Price Rating*	Abrasion Resistance	Edge Toughness	Red Hardness	Grindability	Typical Applications
Molybdenum Type High-Speed Steels	M-1	11	Good	Very Good	Good	Very Good	A substitute for T-1. Broaches, countersinks, hobs, drills, reamers, milling cutters, taps, and thread chasers.
	M-2	10	Good	Very Good	Good	Good	A substitute for T-1 or T-2, having good edge strength. Broaches, countersinks, drills, hobs, reamers, milling cutters, gear-shaving cutters, form cutters, taps and dies, and chasers.
	M-3 Type 1	9	Very Good	Good	Good	Fair to Good	A better substitute for T-1 or T-2. Broaches, counterbores, hobs, reamers, drills, lathe tools, and taps and dies.
	M-3 Type 2	9	Very Good	Good	Good	Fair	A substitute for T-3. Round and flat broaches. Counterbores, hobs, reamers, taps and dies, lathe tools, and special cutting tools for plastic and non-ferrous materials.
	M-4	9	Excellent	Good	Good	Poor	Valuable when used on heat-treated materials, and provides exceptional wear resistance. Form cutters, hobs, milling cutters, drills, and lathe and planer tools.
	M-10	11	Good	Very Good	Good	Good	A substitute for T-1. For fine-edge tools. Boring tools, form cutters, milling cutters, reamers, thread chasers, twist drills, and taps and dies.
	M-36	5	Good	Fair	Very Good	Good	Heavy-duty cutting tools. Drills, form tools, reamers, milling cutters, and lathe, shaper, and planer tools.
Tungsten Type High-Speed Steels	T-1	3	Good	Very Good	Good	Very Good	General die and tool work, including fine-edge tools. Broaches, countersinks, hobs, general cutting tools, drills, reamers, gear-shaving cutters, taps and dies.
	T-2	7	Very Good	Good	Good	Good	Superior for fine-edge tools and general shop tool work. Broaches, boring tools, counterbores, drills, gear cutters, hobs, and cut-off tools.
	T-3	6	Excellent	Fair	Good	Fair	Round and flat broaches. Hobs, drills, reamers, countersinks, boring tools, and lathe tools.
	T-4	4	Good	Fair	Very Good	Good	Heavy-duty cutting tools. Boring tools, forming tools, lathe tools, trimming tools, taps, gear cutters, and shaper and planer tools.
	T-5	2	Very Good	Fair	Excellent	Good	High-production, heavy-duty cutting tools. All types of turning tools, boring tools, and corrugating tools (roughing).
	T-6	1	Very Good	Fair	Very Good	Fair	High-production, heavy-duty cutting tools. All types of turning and boring tools for cast structures, chilled roll necks, and axles.
	T-15	3	Excellent	Poor	Excellent	Poor	Highest hardness and wear resistance. Blanking dies and punches, veneer-cutting knives, turning tools, and dovetail and circular form tools.

*Higher numbers indicate a lower price

off, it is advisable to use a less brittle material for best results.

High-Speed Steels for Shaving Cutters

High wear resistance combined with maximum toughness are properties desired in rotary gear-shaving cutters. Both T-1 and M-2 grades are used for such cutters. The T-1 grade costs about 50 per cent more. The M-2 material is lighter in weight, provides slightly more hardness, and is tougher than the T-1 grade. The selection of grade for a particular shaving cutter depends upon cost, manufacturing, and tool wear life conditions.

Manufacture of Tools Before Heat-Treatment

The manufacture of high-speed steel cutting tools is divided into two phases: the machining of the tool in the soft state and grinding in the heat-treated state. When soft, the steel must be properly handled during rolling, forging, and annealing to make it economical to machine. Also, it must be free of stresses and have a satisfactory finish. Forgings for shaving cutters, for example, must have proper grain flow and carbide distribution.

Machining must be done in such a manner that stresses are not set up which will cause distortion during subsequent heat-treating. The finish should be free of rough tool marks, sharp corners, and deep stamping marks, all of which promote stresses that can cause cracking in heat-treatment or fatigue failure in use.

Close control of machining operations is an additional factor in the total wear life of the tool. The turning of a high-speed steel broach, shown in Fig. 1, is an important operation. Lengths of the lands must be held to close tolerances at this stage. If these lengths are not maintained accurately, broach wear life may be shortened considerably. Sufficient material must be removed in turning to avoid decarburized surfaces after subsequent grinding.

An inspection operation on parts in their soft state promotes the production of top quality tools. It is here that turning operations can be controlled and corrected. Excessive stock removal in grinding can be avoided by adequate green inspection operations. Also, extra annealing operations will not be required.

Heat-Treatment of High-Speed Steel Tools

Proper heat-treatment of a high-speed steel tool involves more than knowing the specified temperatures for hardening and tempering. Much experience and a knowledge of metallurgy are also required. Proper processing must often include a stress-relieving treatment before the regular heat-treatment of the tool. The best possible microstructure at the proper hardness is assured only if suitable control instruments are provided on the furnaces. Correct time and temperature are required for proper heat-treatment.

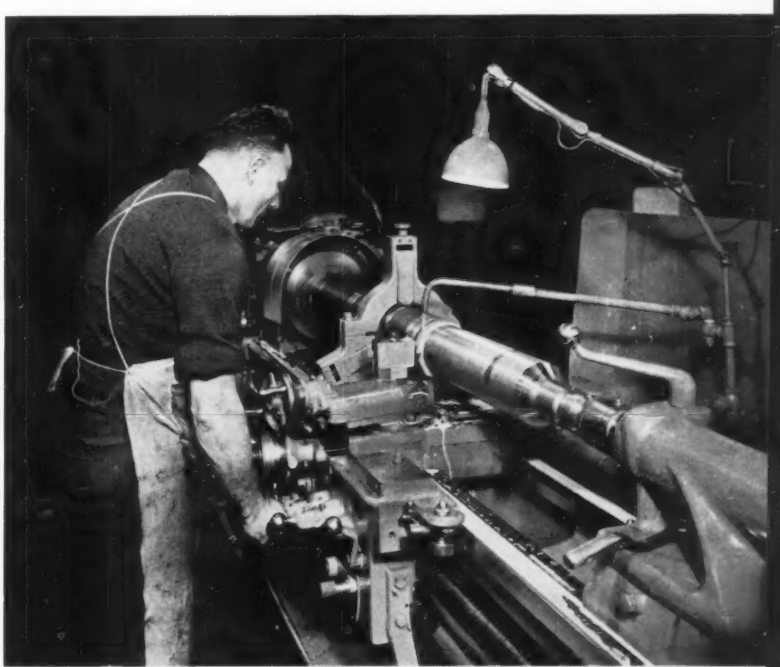


Fig. 1. The turning of a high-speed steel broach is one of the important soft-state operations. Holding close tolerances at this stage will help to avoid excessive time and trouble when the broach is ground.

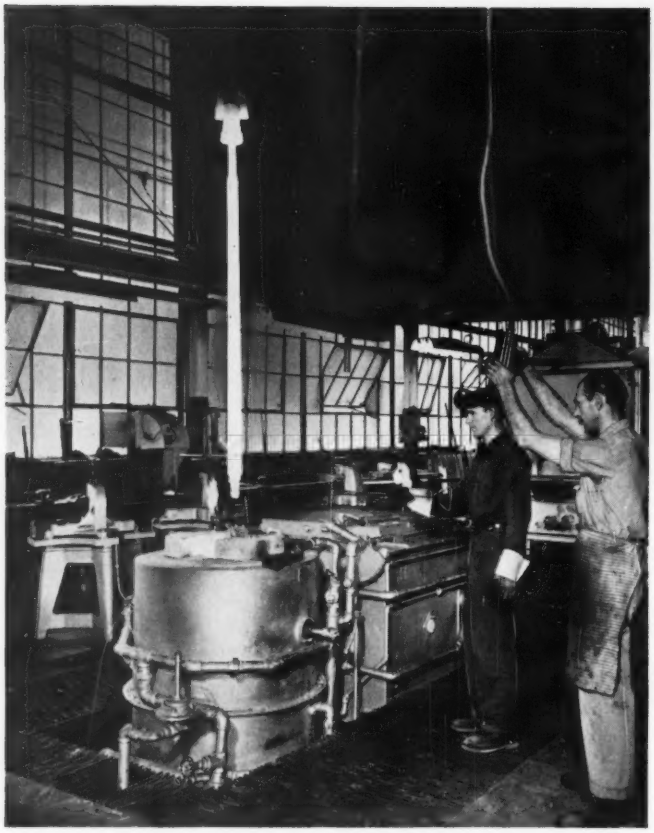


Fig. 2. A white-hot broach is raised from a high-temperature pit furnace to be quenched. Uniform hardness over the entire length of the broach is insured by a three-zone temperature control.

Fig. 3. Broaches are straightened on a hydraulic press after hardening. This eliminates realigning operations during the grinding process.

High-speed steel broaches are heat-treated to a hardness ranging from 61 to 66 Rockwell C, depending on the shape of the tool and the operational requirements. Proper atmosphere and a consistent temperature from top to bottom in a vertical furnace are required to obtain a uniform hardness over the entire length of a long broach. Such a furnace, having a three-zone temperature control, is shown in Fig. 2, where a white-hot broach is seen being raised from a high-temperature pit furnace to be transferred to an oil quench.

Straightening of long broaches at the proper temperature, as illustrated in Fig. 3, is an important consideration in the heat-treating operation. If this is done correctly, broaches will remain straight during the grinding operation and throughout their useful life. Incorrectly processed broaches often have to be restraightened as many as three times during the subsequent grinding operations.

Rotary shaving cutters are also hardened to a 61-66 Rockwell C range. Optimum control of hardness is provided with automatically controlled furnaces. These high-speed steel tools are processed through a double preheat, high heat, and salt bath quench heat-treating sequence.

Many makers of high-speed steel tools have developed surface treatments that are applied to the tools after grinding. The Red Ring Naloy treatment assures complete transformation of the material to a martensitic structure and provides surfaces with high skin hardness that resists abrasion. Naloy-treated gages, for example, have outlasted chromium-plated gages by ten to one in actual tests, thereby attesting to the value of surface treatments on high-speed steel tools.

Grinding of High-Speed Steel Tools

Grinding of high-speed steel tools after they are hardened is a precision manufacturing operation that is critical in providing maximum tool performance. Not only must size and shape be accurately held, but a good finish must also be produced without burning the cutting edges or setting up stresses. Burning of the tool during grinding operations, which is often a non-visible condition, may cause complete or at least premature tool failure. Heavy cuts or improper grinding methods can cause surface cracks or produce a soft skin that will not resist wear.

Rough surface finishes tend to shorten tool life. Often, the stoning of feather edges on a tool after sharpening will prolong its length of service. Fine finishes on the cutting surfaces of high-speed steel tools, similar to those provided on carbide tools, insure best results. A typical operation on a high-speed steel cutting tool, in which close accuracy is required in grinding after hardening, is shown in Fig. 4. Here a shaving cutter mounting hole is being checked after grinding to a 0.0002-inch tolerance, which is controlled by a precision air gage. Another precision grinding operation on a shaving cutter is illustrated in Fig. 5. In this set-up, the involute tooth

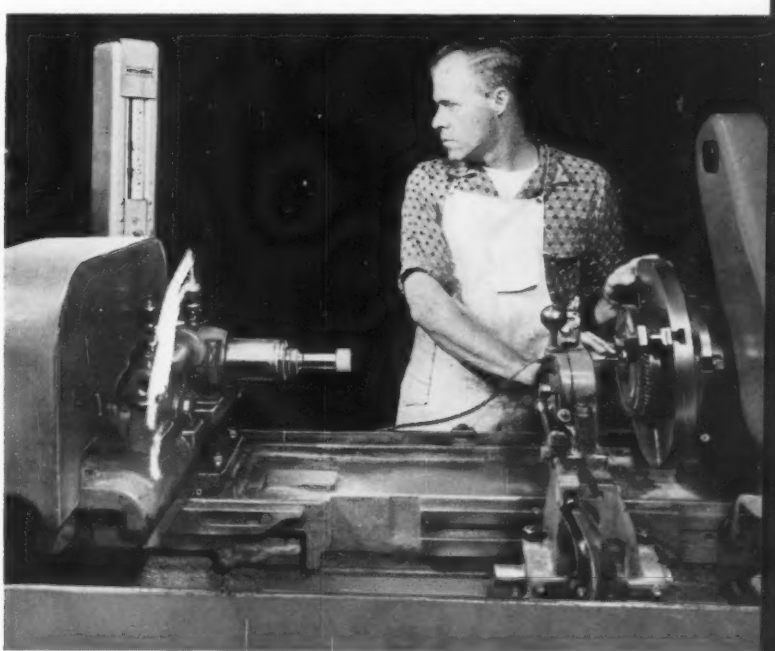


Fig. 4. A precision air gage is used to check a 0.0002-inch tolerance on the mounting hole of a rotary high-speed steel shaving cutter.

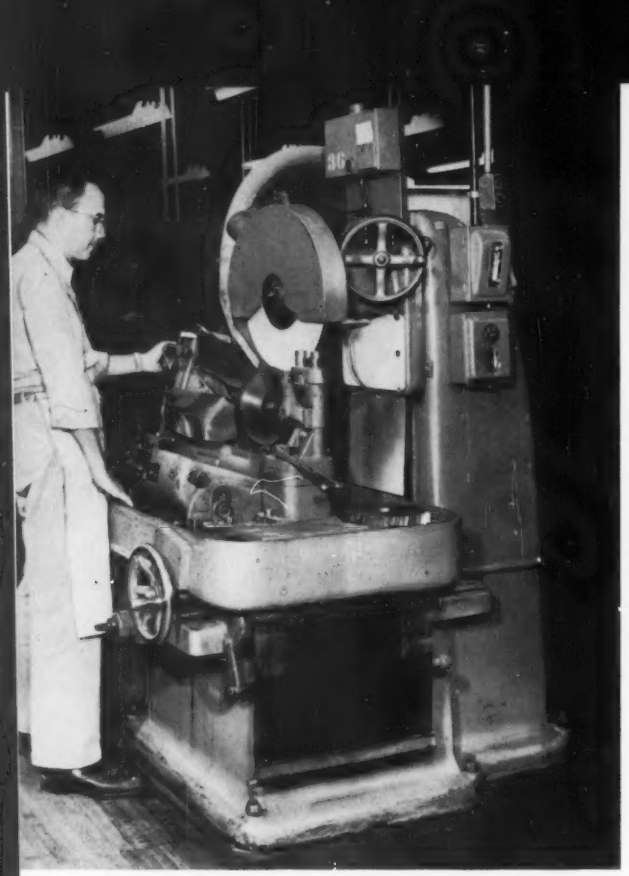


Fig. 5. Extreme accuracy is required in grinding the involute tooth form on a shaving cutter. Close tolerances and fine surface finishes promote longer tool life.

form is being ground to an accuracy of 0.0002 inch, or less.

The faces, peripheries, and splines of high-speed steel broaches are ground after heat-treating. The face-grinding operation on a broach is shown in Fig. 6. Cylindrical grinding operations are done with abrasive wheels whose surfaces are conditioned by a slow, fine dressing method. This assures smooth, wearproof surfaces on the broach.

Spline teeth are ground from the solid on broaches of the design shown in Fig. 7 to avoid heat-treating cracks that may occur at the root of milled splines. Extremely accurate index-plates and wheel-dressing methods are required to grind the involute form on internal, helical gear broaches of this type.

Proper inspection of ground high-speed steel tools before they are shipped to the customer is essential to insure accuracy and uniformity of performance. Such precision inspections as checking the lead of rotary shaving cutters (see Fig. 8), or checking the size of a slab broach, as shown in the heading illustration, must be made by tool manufacturers in order to assure maximum performance in later use.

High-Speed Steel Tool Trouble-Shooting Check List

When a properly designed, manufactured, and heat-treated tool does not give good performance in use, the difficulty can usually be located by

Fig. 6. Face-grinding operations on broaches are done with finely dressed abrasive wheels to produce an even surface finish and to maintain accuracy.

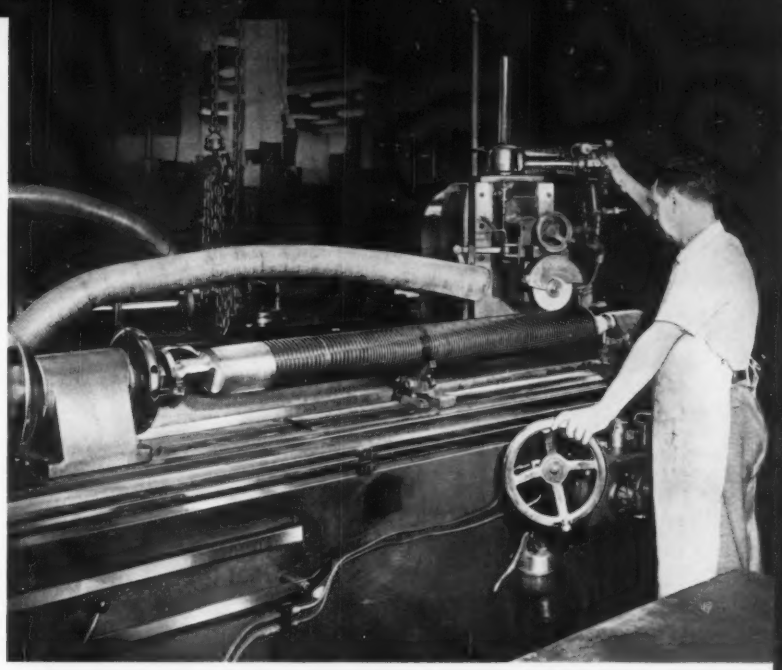


Fig. 7. Best results are obtained by grinding the spline teeth from the solid. Milling these splines may cause heat-treat cracks at the root of the spline.

studying the application of the tool. The following check list will be helpful in finding the source of trouble.

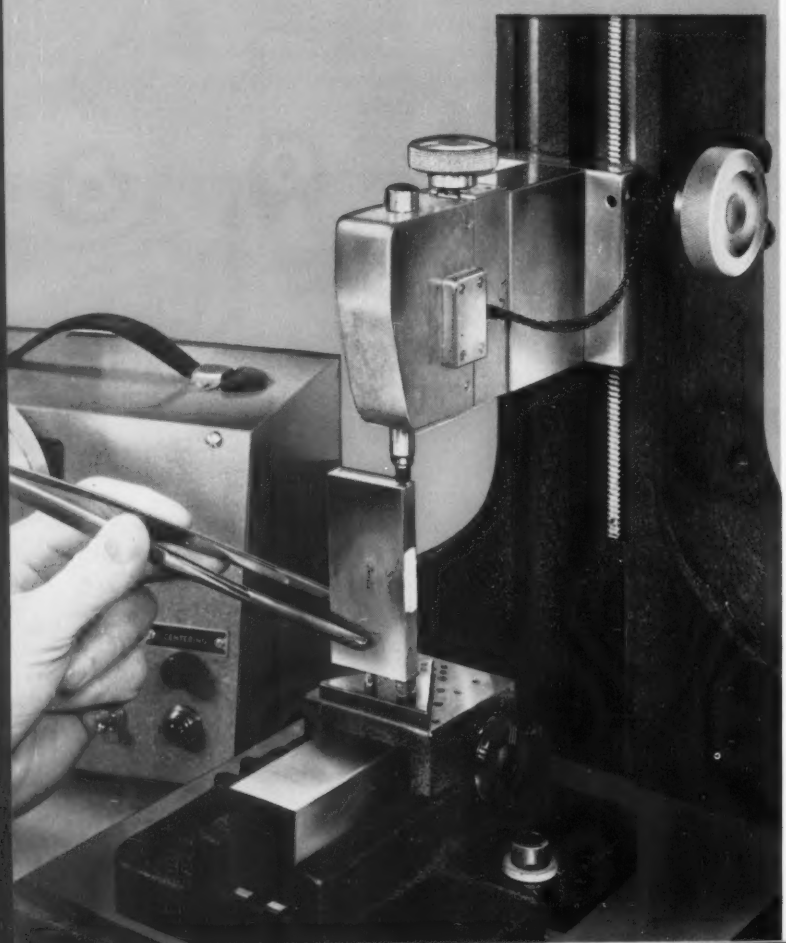
1. The machine tool has loosened up and needs repair.
2. An error in alignment exists.
3. Tool material has been changed without authorization.
4. Hardness of the changed material is too low or too high.
5. Microstructure of the changed material is different.
6. A revision in a prior machining process may have caused a change in surface finish or in structure.
7. Coolant has broken down or become contaminated by chips.
8. Wrong coolant is being employed.
9. Tool is being used too long without resharpening.
10. Poor sharpening practices.
11. Feeds and speeds have been changed.
12. Chips are not being properly removed during the operation.

Fig. 8. Precision inspection of completed tools insures maximum performance in use. Here the lead of a rotary shaving cutter is shown being checked.

How to Calibrate Your Gage-Blocks

Precision gage-blocks can be accurately calibrated in your own plant with a few pieces of simple equipment and careful attention to prescribed rules. Air-conditioned facilities are not required, and the equipment necessary is comparatively inexpensive

By FREDERICK O. HUTCHINSON, Vice-President
The DoALL Co., Des Plaines, Ill.



GAGE-BLOCKS are fixed standards of length that make possible accurate calibration of fine instruments used for precise measurements. Even relatively broad tolerance Grade B gage-blocks are finished to an accuracy in length of plus or minus 0.000008 inch, hardened to 65 Rockwell C, and stabilized so that they will retain their exact size over a long period of time.

Like all other steel tools, however, gage-blocks wear as the result of use, and must be calibrated from time to time—the frequency of calibration depending on the degree of use. Worn gage-blocks can be the source of much trouble, but if they are accurately calibrated, and the amount of wear is taken into account, they can be as dependable as new blocks for many inspection applications.

Most users of gage-blocks send the blocks to the National Bureau of Standards, or return them to the manufacturer, for such periodic calibrations. However, the blocks can be accurately calibrated in their own plants by carefully following certain rules. Only a few pieces of simple equipment are required, and expensive air-conditioned facilities are not necessary.

As an educational service to industry, The DoALL Co., Des Plaines, Ill., manufacturers of precision gage-blocks, has prepared detailed information on how to determine whether gage-blocks require calibration, and recommended methods of calibration. This information, published as a metrology manual entitled "How to be Your Own Bureau of Standards," forms the basis for this article.

Fig. 1. Minimum requirements for inspecting gage-blocks include a bench, a monochromatic light, an optical flat, a deburring stone, and cleaning equipment.

Technique for Inspecting Gage-Blocks

Equipment required for the adequate inspection of gage-blocks includes a bench, a monochromatic light, an optical flat, a deburring stone, cleaning solvent, a cleaning pan, towels, and a camel's hair brush, as illustrated in Fig. 1. Only the monochromatic light, the optical flat, and the deburring stone would not be found in the average shop, and these inspection tools are relatively inexpensive compared to the investment in even one set of gage-blocks. The bench should have a solid, 2-inch thick hardwood top, and be located away from drafts, dust, and fumes.

Gage-blocks to be inspected must first be thoroughly cleaned. This is easily done by laying them on a clean cloth in the bottom of a shallow pan, and covering them with clean naptha or similar cleaning fluid. Each block is taken from the cleaning bath, dried with lint-free towels (Fig. 2), brushed to remove stray particles of lint or dust, and placed, gaging surface up, under the beam of the monochromatic light.

The optical flat and monochromatic light make possible the application of interferometry for quick and positive inspection of the gage-block working surfaces. The DoALL Monolite uses a helium gas tube to project a pale yellow light having a single wave length of 0.0000232 inch. When a lapped surface such as that on a gage-block is illuminated by this light and viewed through an optical flat, Fig. 3, a pattern of dark bands called fringe lines becomes visible. The optical flat can be of clear fused quartz or glass, lapped flat to within as little as 0.000001 inch. Gage-blocks less than 0.100 inch in length must be wrung to a second optical flat for the flatness check.

Fringe lines form a "contour map" which can be interpreted to indicate how closely the surface under inspection corresponds with a true plane. This is a rapid and simple method for detecting nicks, burrs, and signs of wear that might indicate a need for complete calibration. If the pattern visible through the optical flat is one of many parallel fringe lines, it is an indication that something is preventing the optical flat from making close contact with the gage-block surface. Such a pattern could be caused by a dust particle, a microscopic burr at the edge or on the face of the block, or a particle of grit embedded in the gaging surface. If brushing of the mating surfaces of the block and optical flat does not change the pattern, the block should be washed again and the procedure repeated.

When a pattern of numerous fine fringe lines persists, it is an indication that a deformation (either a burr or embedded grit) exists on the surface of the block. This condition renders the block unreliable as a gaging instrument, and introduces a possible source of damage to other blocks when used in combination with them. The gaging surface of such a block should be rubbed firmly across the clean surface of a deburring stone, Fig. 4, until the block begins to

Fig. 2. A lint-free towel is employed to dry the gage-blocks as they are removed from the cleaning bath consisting of clean naphtha in a shallow pan.

"wring" or drag on the stone. Dense and hard black granite makes an ideal deburring stone, as this material has just enough surface porosity to catch and remove microscopic burrs. Also, the smooth crystalline flat surface of lapped granite will not abrade the fine gaging surface of the block.

Deburred blocks should again be washed, dried, and checked under the monochromatic light. If the patterns contain relatively few parallel lines, as seen in the three views at the top of Fig. 5, the gaging surfaces of the blocks are nearly perfectly flat. However, if the patterns appear as shown in the three views at the bottom, it is an indication that the blocks are badly worn. If many blocks in the set look like this, the set should not be relied on for critical inspection jobs. Even those blocks in the set that are flat should be checked, since they may have worn evenly during constant use on a master flat or indicator anvil. Calibration of the entire set is definitely recommended.

Fig. 3. Pattern of fringe lines becomes visible when the surface of the gage-block is illuminated by monochromatic light and viewed through an optical flat.

Fig. 4. Here a lapped granite block is being used to remove microscopic burrs from surface of a gage-block. Dense hard granite is ideal for this purpose.

Charts included at the back of the DoALL manual make it possible to classify the blocks as to flatness, and to estimate the amount of error in flatness that may exist. Also, a suggested inspection record is presented. As the blocks are checked, their condition should be noted on such a record, and the record kept on file for reference after subsequent inspections. When the entire set has been inspected, the blocks should again be cleaned to remove fingerprints and coated with petroleum jelly or other rust preventative. Also, the container case should be washed in naptha, scrubbed with a soft brush to remove caked grease, and blown dry with compressed air.

Calibrating Gage-Blocks

To calibrate gage-blocks, it is necessary to measure differences in length as small as 0.000001 inch. The procedure is simple but exacting, and requires an intelligent, patient, and careful inspector. The National Bureau of Standards, The DoALL Co., and a few other organizations have expensive interferometers for establishing and maintaining grand master reference gages upon which the accuracy of all gage-blocks depends. Fortunately, instrument manufacturers have developed lower cost electronic comparators which permit precise comparison of unknown size blocks with gage-blocks of known dimension.

For size calibration, the work-bench and its location are more critical than for inspecting the flatness of gage-blocks. The bench should be sturdy and at least 6 feet long by 30 inches wide with a 2-inch thick top, preferably of hard wood. It should stand on sponge rubber pads or other devices to isolate the comparator from any vibration. The bench should be located in a room at least 8 by 10 feet and closed off from the rest of the shop. While the room need not be air-conditioned, the temperature must not be allowed to change more rapidly than 3 degrees per hour. For this reason, it is best not to have windows to the outside. If outside windows are unavoidable, the bench should be located as far away from them as possible, and the windows covered to block direct sunlight. While calibrating, the door should be kept closed, and only the inspector allowed inside.

Uniform temperature is the most important single factor in gage-block calibration. Since a 1-inch steel block will change 0.0000064 inch in length with every degree of temperature change, it is essential that the unknown and master blocks be identical in temperature. To make this possible, drafts must be kept from the calibrating area. One method of accomplishing this is to place plywood baffles at the ends or sides of the bench to deflect air currents.

Light is another source of unwanted heat. Fluorescent ceiling lights should be hung as far away from the bench as possible, and not directly over it. Since heat is reflected by light colors and absorbed by dark-colored objects, the

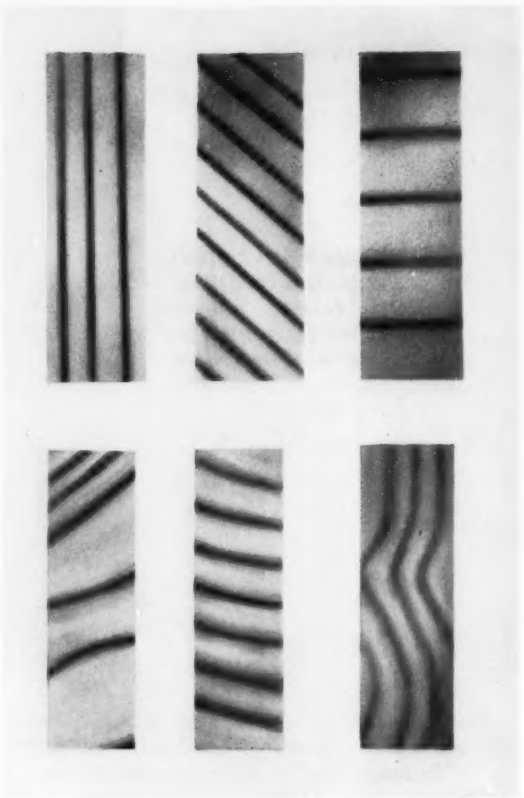
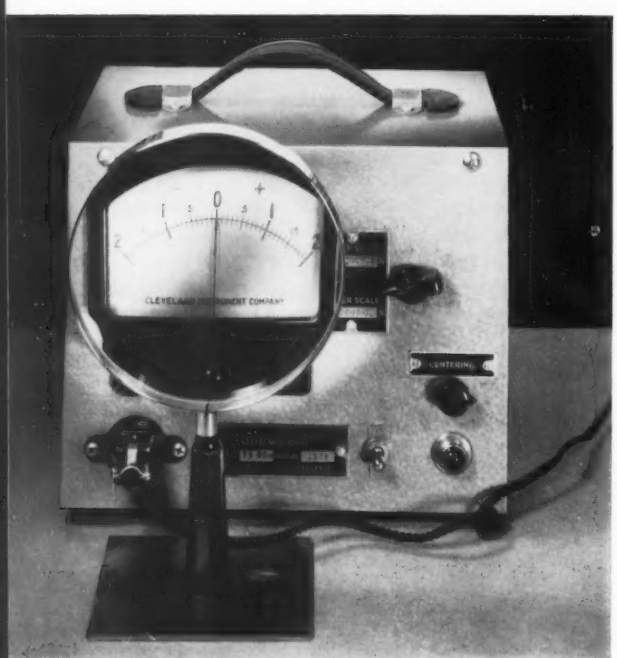


Fig. 5. Three views at top, illustrating parallel fringe lines, indicate flatness of gage-block surfaces. Patterns at bottom show that the blocks are badly worn.

top of the bench should be of light, natural finish, or covered with light paper. A dark green linoleum top, for example, can cause erratic measurements because it will absorb more heat from light rays than the reflective surfaces of the gage-blocks, and some of the heat will be transferred to any blocks placed on its surface. If more than one bench is used, they should be of the same height since the temperature in any room varies considerably from floor to ceiling.

A set of Grade A master gage-blocks made by a reputable manufacturer and calibrated by the National Bureau of Standards or the manufacturer is another essential piece of major equipment for in-plant calibration. DoALL Grade A gage-blocks are furnished with a calibration report, making them suitable for use as master gages without the expense or time of recalibrations. Also required is a sensitive comparator having a dial calibrated with not more than ten graduations per inch, and meter ranges of 0.000001 and 0.000010 inch per graduation. The comparator should have adjustments for centering one scale to the other, as well as an adjustment for linearity. The Cleveland Micro-AC electronic comparator seen in the heading illustration meets these specifications. A 0.125-inch radius diamond is provided for the spindle tip, and the anvil has three boron carbide tips located adjacent to each other for three-point suspension of the work. A magnifying viewer, Fig. 6, is used to minimize parallax error. This comparator can be used for production gaging operations as well as for calibration purposes.



Another item needed for calibration is a temperature normalizing plate. This steel plate can be approximately 24 inches square by 1/2 inch thick, with a ground and polished top surface, or covered with aluminum foil as seen at the top in Fig. 7, to provide a bright surface. Legs 1 inch high should be provided under the plate to permit air circulation. The plate should be located on the bench as far away from the inspector as possible while still permitting him to reach the blocks that will be located on it. Insulated forceps are used for handling the gage-blocks, as shown, to minimize heat transfer from the inspector's hands.

The gage-blocks to be calibrated, called the "unknown blocks," should first be checked for burrs and calibrated for errors in flatness as

Fig. 6. Magnifying glass minimizes parallax error in reading dial of comparator, which has ranges of 0.000001 and 0.00001 inch per graduation.

previously described. Then, together with the master blocks, they should be arranged on the normalizing plate. Each unknown block should be placed close to the corresponding master, starting at the back of the normalizing plate with the longest gage-blocks and leaving only enough space between them to permit inserting the forceps. The reason for placing the larger blocks at the back is to keep them as far away from the inspector as possible to reduce any transfer of heat from his body. Smaller blocks, having a greater percentage of area in contact with the normalizing plate, are less susceptible to this effect.

Gage-blocks should be allowed to stand in the closed, draft-free room for at least one hour per inch of length of the longest block. For example, when calibrating an 83-piece set in which the largest block is four inches long, the blocks and masters should stand for at least four hours before any attempt at measurement is made. Beginning with the longest block, the comparator is set to include any deviation in the master block. Thus, if the master block calibration chart shows the 4-inch long block to be 0.000002 inch over size, the comparator is set for this amount. Then, any deviation of the unknown block can be read directly from zero. When the master block has been returned to the normalizing plate, the unknown block is placed on the comparator and measured at its center, as seen in Fig. 8.

Size readings are recorded on a calibration record. The comparator setting should again be checked with the master, and the unknown block rechecked. This procedure should be repeated, and all three readings recorded. The readings should agree within 0.000002 inch, in which case the average of the three readings can be accepted as the "true size" of the unknown gage-block. This routine is repeated for the remainder of the set, working from the larger blocks down to the smaller.

Since the blocks have been checked only at their centers, it is possible that some have worn at the ends so that their surfaces are no longer parallel, and therefore not within the size tolerance throughout the gaging area. They can be checked for parallelism by rearranging the three-button anvil so that two of the buttons support the block at one end, and the third at the other end. Then, as seen in the heading illustration, the anvil is located on the comparator so that the spindle tip makes contact approximately 1/32 inch inside the two buttons at one end. This procedure is then repeated to obtain readings at the opposite end of the unknown blocks. Any deviation between these measurements and the one made at the center are noted on the calibration record as an error in parallelism.

When using gage-blocks other than steel, such as tungsten or chromium carbide, certain characteristics must be taken into consideration that may affect the accuracy of calibration. For example, the thermal coefficient of expansion for

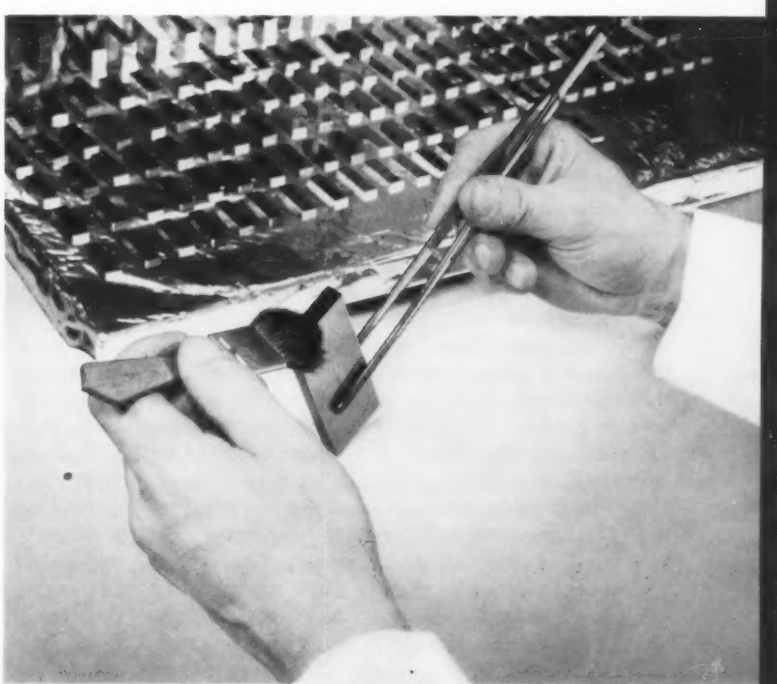


Fig. 7. Gage-blocks are handled with insulated forceps to reduce heat transfer from inspector's hands. Camel's hair brush is used to remove lint from the block.

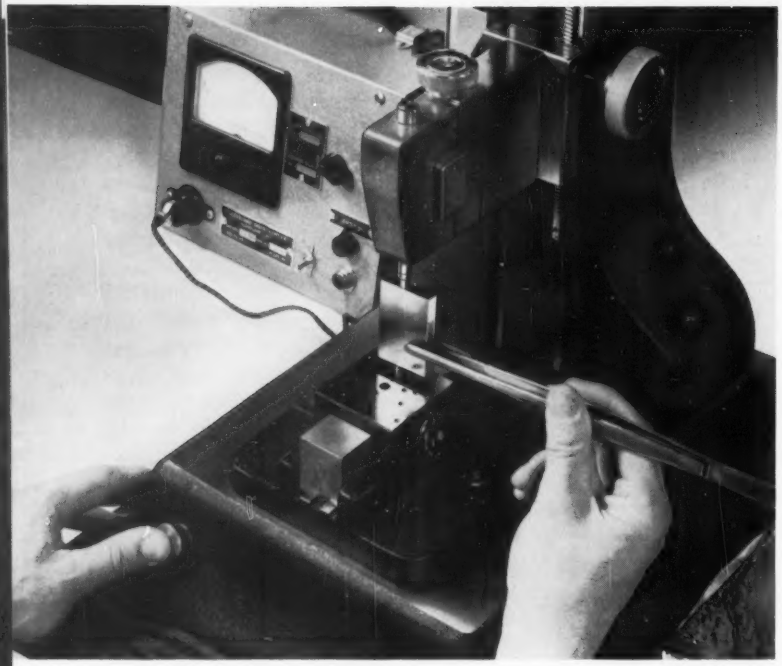


Fig. 8. In calibrating gage-blocks, measurements are taken at the center of the gaging surface, as shown, and at the ends, as seen in the heading illustration.

steel differs from that of tungsten carbide. A 1-inch steel block will change 0.0000064 inch in length for every degree difference in temperature, while tungsten carbide changes only 0.000003 inch per degree, and chromium carbide, 0.0000045 inch per degree. In fact, a carbide block and a steel block of the same nominal size will measure the same length at only 68 degrees F., the temperature at which they were calibrated by the manufacturer.

Obviously, carbide blocks cannot be used as masters to check steel blocks (nor steel blocks used to check carbide blocks) unless the inspection room is maintained at 68 degrees F. Another difference between the materials is elasticity. A 1/8-inch radius diamond tip under 6.4 ounces of pressure will deflect the surface of a steel block to a depth of 0.00001 inch. However, an identical tip under the same pressure will deflect the surface of a tungsten carbide block only 0.0000066 inch. Therefore, a tungsten carbide block and a steel block of the same actual size would apparently differ by 0.0000034 inch in length if checked on a comparator under this pressure, even in an air-conditioned room at 68 degrees F.

To prove that accurate calibration of gage-blocks is possible with average facilities and reasonable care, the DoALL Gage Laboratory undertook the calibration of an 83-piece set under two different conditions. First, in a machine tool manufacturing plant, the inspection was performed in the center of a three-walled area away from the traffic aisles and out of drastic air currents. During this first inspection period, the temperature ranged from 75 to 83 degrees, but did not change more than 3 degrees in any one hour. The next day, a second inspector repeated the calibration again in four hours, during which time the temperature remained constant at 76 to 77 degrees. Both inspection reports agreed within 0.000001 inch for all blocks except the one 4 inches long, in which case there was a disagreement of 0.000003 inch.

Secondly, the gage-blocks and inspection equipment were transferred to an enclosed office inside the plant. This room is enclosed by double pane, soundproof windows, but is not air-conditioned. The temperature varied gradually about 12 degrees, during both four-hour inspection periods. These two reports also agreed within 0.000001 inch; however, the calibrations of the 4-inch block now agreed within 0.000001 inch. These inspections were repeated under controlled conditions in the air-conditioned DoALL Gage Laboratory with the results obtained being practically identical.

This unusual educational program being offered by DoALL to users of gage-blocks and gaging accessories should do much to encourage good habits in the use of gage-blocks and the calibration of gages. Furthermore, it will teach industrial users the techniques so necessary in maintaining their own master gages in a condition where they can be relied on with confidence for precision measurements.

Automation Facts—Not Fancies

(Continued from page 145)

The automotive industry, though in first place as to per cent of potential automation and in first place as to per cent of new-equipment orders calling for automation, is actually in third place as far as total potential market is concerned.

And just note the lowly machinery field with its little figure of only 7 per cent of operations considered as being suitable for automation. Forty thousand production operations! Not a bad market for production equipment, is it?

It just helps to emphasize that it isn't product or plant size or company size that controls automation opportunities. The nature of the operation and how many times it can be repeated before tooling changes are necessary control that. Many small plants specializing in the manufacture of only a few standard items have a better chance to employ automation than the bigger plants.

Now let's take a look at the geographic picture. As expected, we find that the East North Central and Middle Atlantic states lead the parade pretty well with 17 per cent potential automation. But right up there with the leaders, also with an average estimate of 17 per cent, are the southern states—South Atlantic and East and West South Central! Surprising? Not a bit. Industry has discovered, if it has not known it all along, that "cheaper" labor is an economic mirage and delusion. Cheap and untrained labor is expensive if you have to rely on it.

In the South, like everywhere else, automation means better quality control and a chance to consistently get top quality without the kind of highly trained and skilled labor available in the East North Central and Middle Atlantic states.

Want to carry this idea a bit further? Where is the outstanding heritage of the craftsman's skill? The area that first comes to mind of course is New England. Here then, "automation for quality control" should not be as seriously considered as elsewhere. The ASTE study seems to show exactly that. New England's estimate that only 10 per cent of its metal-working operations are in this category is influenced undoubtedly by the local availability of skilled craftsmen.

A further confirmation of this is found in the tabulations of "potential automation of inspection operations." Where other areas show averages of 16 to almost 25 per cent of inspection operations in this classification, New England casts a vote for less than 5 per cent of the total. And while New England's 1956 orders of automated equipment represent a not too unhealthy 10 per cent of the new-equipment dollar to be spent, the 1957 estimates drop to only 5 per cent.

Thus, we have the curious anomaly of a manufacturing trend which on the one hand puts a premium on high worker skill and training, and on the other hand is more readily accepted in areas where average worker skills and training are at comparatively lower levels.

Operation	National Average
Machining Materials handling	20 to 25 per cent
Metal forming Grinding and finishing Inspection	15 to 20 per cent
Production welding	10 to 15 per cent

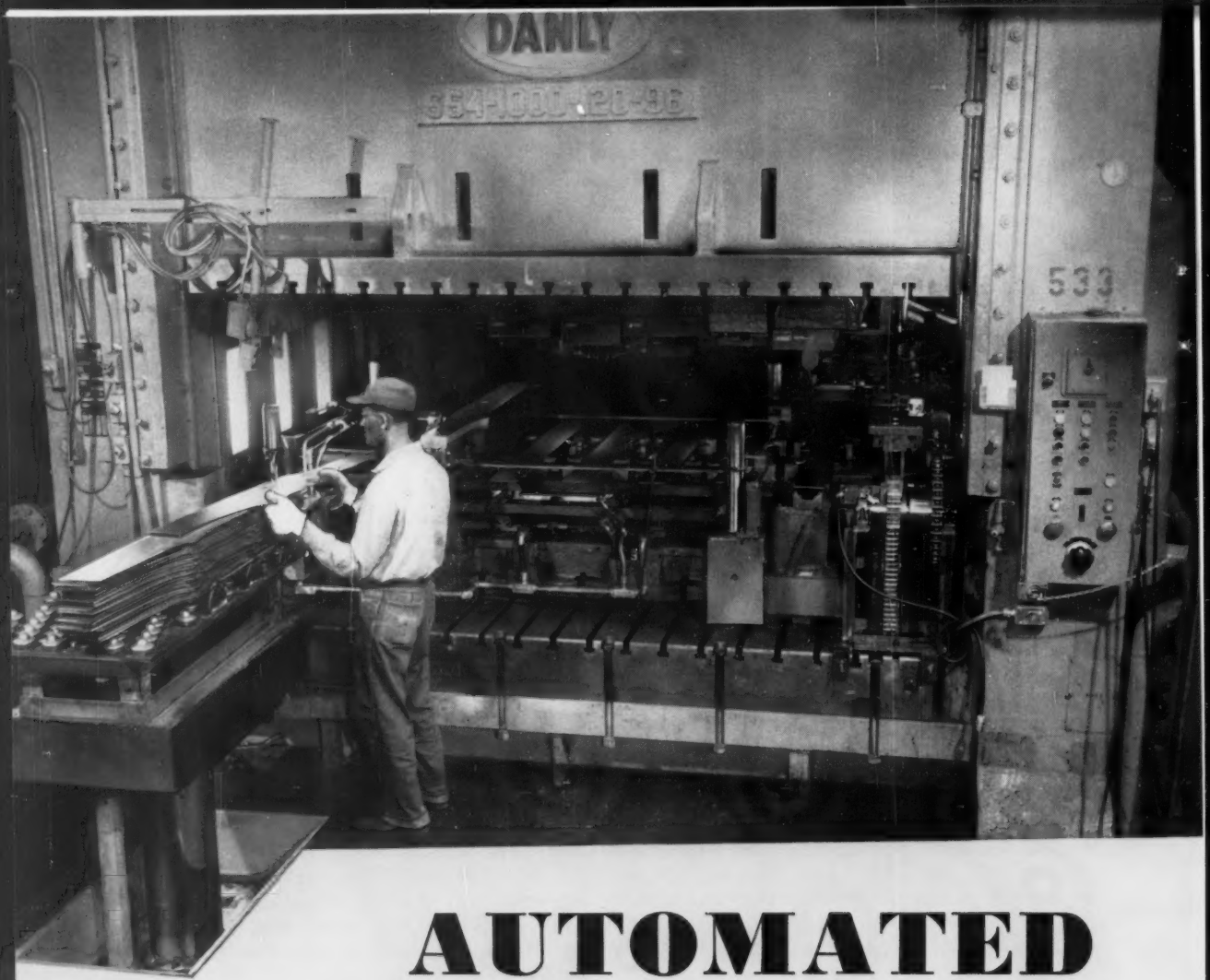
No attempt was made to obtain figures on automation of assembly operations, since these differ so widely between industries, and even between plants in the same basic industry. However, quite a number of companies did indicate a high interest in the automation of assembly operations. These include companies manufacturing refrigerators and radio and television equipment.

The biggest single stumbling block to automation in many plants is the variety of production operations scheduled over the same equipment. Job lot shops do not lend themselves too well to automation at present. They wouldn't mind it, however, if somebody came along with low-cost standardized automation units that would work on short runs and job lots.

This brings up one more point. The survey definitely shows that automation is going to have a big effect on product design. When engineers design a product in the future, they will have to take production methods much more into account than before, if the product is to be produced on at least partially automated equipment.

Obviously, there will have to be a closer liaison between design engineering and tool engineering, for it is the tool engineer who will have to carry the big burden of "how to do it and with what." The average tool engineer will be required to know a lot more under automation than he had to know in the past. His worries haven't changed. They've just been added to.

Sure, the tool engineer had a simple job. After all, he is nothing but "a technically trained individual who uses his engineering ability, experience, and training in the development or application of the tools of production." But, when you add electronics, kinetics, and hydraulics; punch-card and tape controls; and such simple little things as cybernetics to those tools of production, you surely haven't made his job any easier.



AUTOMATED

Stamping of Rear-Axle Housings

Transfer presses with ingenious dies, automatic loading and unloading devices, interesting welding operations, and the latest type automation equipment have been combined for the rapid and economical production of Buick rear-axle housings from 0.180-inch thick coil stock and flanges from 11/32-inch thick plate

By CHARLES H. WICK
Associate Editor

AMONG the major developments that have been incorporated in expanding facilities to permit Buick Motor Division of General Motors Corporation to attain a planned capacity of 1,000,000 automobiles per year is a completely new rear-axle housing line. This line is equipped with the most modern automation units, as well as automatic loading and unloading devices, to allow higher output and more economical production. Also, transfer presses having dies of ingenious design are used, and unusual welding operations are employed to insure improved quality parts.

Rear-axle housings for Buick cars were previously made by butt-welding together right- and left-hand halves, the split being through the "banjo" section perpendicular to the axis of the housing. Now, a stronger housing is obtained by

seam-welding upper and lower halves, with the split along the axis. Also, the new design permits more economical nesting of blanks on the stock strip and the use of commercial quality steel instead of deep-drawing quality previously needed.

Coil stock of SAE 1008 steel, 0.180 inch thick by 17 inches wide, is employed for forming the housing halves. Each coil weighs approximately 8300 pounds and is lifted into a Littell cradle by means of a 10-ton hoist suspended from an overhead monorail. A storage area is provided for about thirty days' supply of raw material, which is equivalent to about 600 coils, or 5,000,000 pounds of steel.

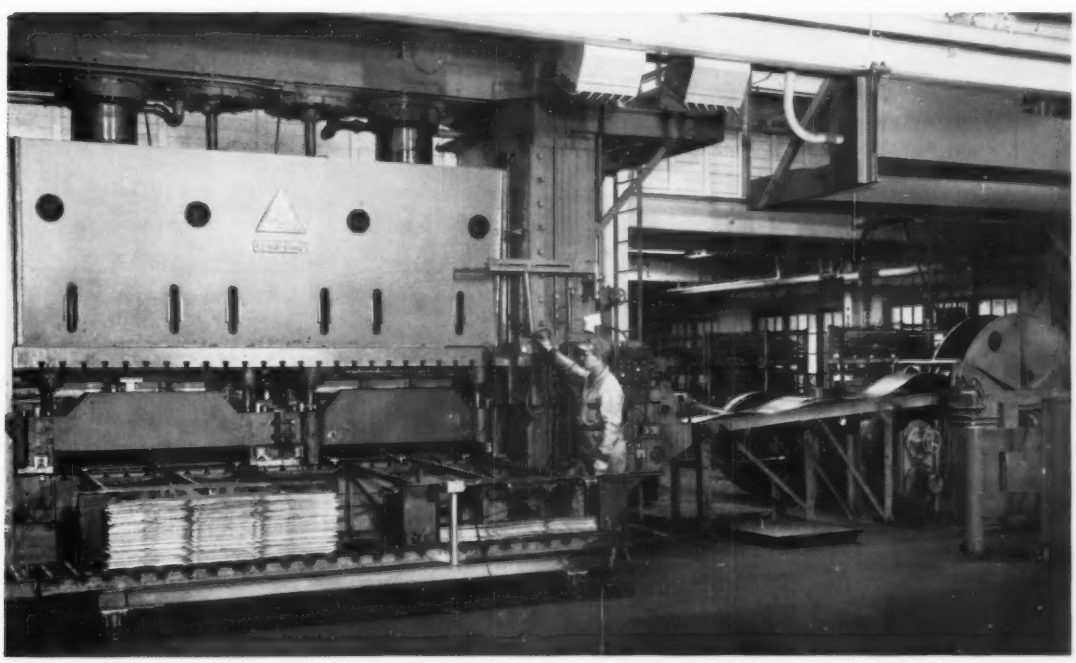
From the coil cradle, the stock automatically passes between feed and straightening rolls and into the Clearing two-point suspension, 1500-ton press seen in Fig. 1. This press operates at sixteen strokes per minute and has a bed area 160 inches from left to right by 42 inches from front to back. A two-station die produces two identical developed blanks (one upper and one lower housing half) with each stroke of the press. At the first station, a blank is cut near one edge of the coil stock, and, at the second, another blank near the opposite edge. Developed blanks for certain car models are about 56 inches long, and, for other models, 59 inches long.

An interesting side light to the production of rear-axle housings is the attempt made to fully use all available material. A scrap cutter mounted at the end of the blanking press chops the used coil stock into predetermined sizes. This metal is placed in an adjoining battery of six presses to stamp washers, body shims, levers, and other miscellaneous automotive parts, thus effecting considerable savings and reducing the amount of material sold as scrap.

Blanks produced on the Clearing 1500-ton press are automatically ejected onto a conveyor, which carries them to a Danly four-point suspension, 1000-ton press, shown in the heading illustration and Fig. 2. This press operates at twelve strokes per minute and has a bed area 120 inches from left to right by 96 inches from front to back. The blanks are stacked in a hopper and are automatically picked up, one at a time, from the open bottom of the hopper by a transfer mechanism. This mechanism indexes the blanks, in 13-inch increments, to five successive dies.

At the first station, four corners on each flat blank are balled. The edges on the banjo section of the housing are successively flanged to an angle of 90 degrees, then 135 degrees, and finally flattened to 180 degrees in the dies at the second, third, and fourth stations. In the final die, at the fifth station, the part is V-formed. Fig. 3 is a schematic drawing showing the arrangement of the hopper and five stations, with work-pieces shown in position in each die.

Fig. 1. Developed blanks for forming rear-axle housings are stamped from 0.180-inch thick coil stock, two at a time, on this 1,500-ton press.



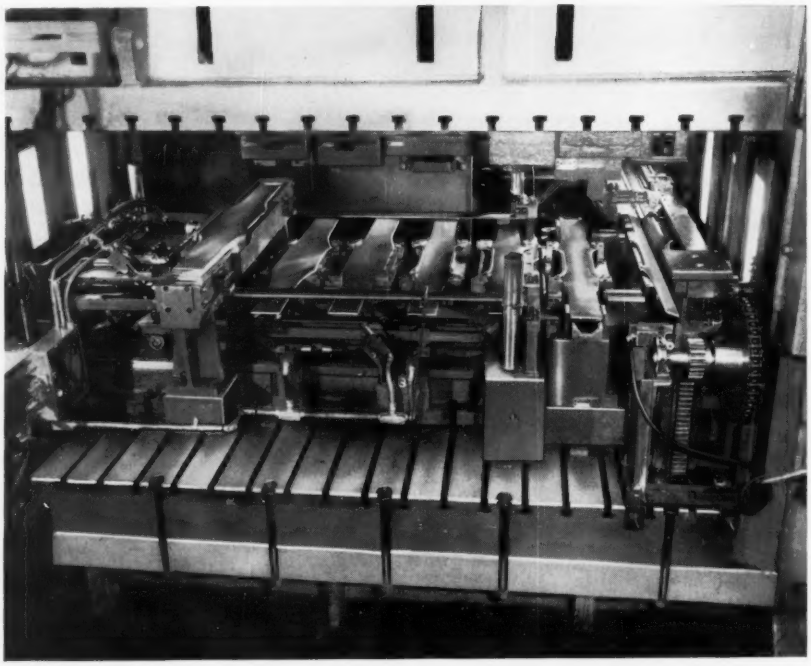
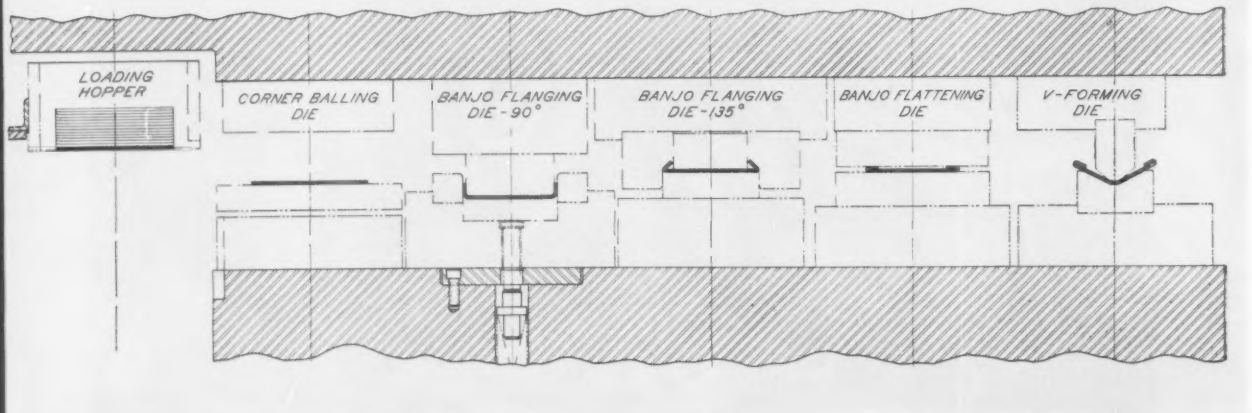


Fig. 2. Hopper feeding unit and five dies are mounted on this 1000-ton press for successively flanging, flattening, and forming of axle housings.

Automatic indexing of the parts from station to station is accomplished by a transfer bar which is raised and lowered by levers actuated by an air cylinder, and advanced and retracted by a slide that is moved by another air cylinder. A schematic drawing of this transfer mechanism is shown in Fig. 4. When the press ram rises, a cam trips a limit switch (L.S. 1 on the drawing), thus energizing solenoid valve *A* which actuates air cylinder No. 2. This cylinder has a 5-inch diameter bore and a 4-inch stroke. As the piston-rod moves to the right, the toggle lever arrangement *E* raises the transfer bar 3 7/8 inches, thus lifting the parts from the dies.

When the transfer bar reaches its uppermost position, it trips the second limit switch (L.S. 2) to energize solenoid valve *B* and actuate air cylinder No. 1. This cylinder has an 8-inch diameter bore and a 13 1/2-inch stroke. The piston-rod is connected to a slide and, as it moves to the right, advances the transfer bar to carry each part to the next station. A bumper *X*, mounted on the

Fig. 3. Progressive shapes produced in press seen in Fig. 2. Blanks are automatically picked up from open bottom of hopper, at left, and indexed to dies.



slide, contacts a third limit switch (L.S. 3) at the end of the forward stroke. This switch energizes solenoid valve *C*, which reverses the action of cylinder No. 2 to lower the transfer bar and position the parts in the dies. As the transfer bar reaches its lowermost position, a fourth limit switch (L.S. 4) is tripped to energize solenoid valve *D* and reverse the action of cylinder No. 1. The transfer bar is thus returned to its original position, ready for the start of the next cycle.

Flanged and V-formed rear-axle housings are automatically unloaded from the fifth-station die on the Danly 1000-ton press, and carried by a chain-driven continuous conveyor to the first-station die on a Cleveland four-point suspension, 2000-ton press, Fig. 5. This four-station press, having a bed area 120 inches from left to right by 96 inches from front to back, also operates at twelve strokes per minute and is synchronized in action with the preceding press.

At the first station in the Cleveland press, the V-formed housing is drawn to form a U-shaped banjo section. A die at the second station restrikes the U-section and coins the semicircular ends on the housings. The ends are trimmed at the third station, and the housings unloaded at the fourth.

Automatic transfer of the housings from station to station is accomplished by a unique combination of air cylinder lifters, positive knockouts, and work-carrying fingers. The fingers, mounted on right- and left-hand carriages extending along both sides of the press, are moved inward and upward, as well as retracted, by cams and linkage connected to the press ram. A limit switch actuated, solenoid valve controlled air cylinder reciprocates the finger carriages through an 18-inch horizontal stroke to index the parts to successive dies.

An operational cycle can be described by referring to Fig. 6, which is a sectional drawing through the first-station die. When the press ram starts to rise, the work-piece *X* is lifted in the die by pin *A*, which rests on an extension rod *B* connected to the piston-rod of air cylinder *C*. This cylinder, located in the bolster plate on the press, has an 8-inch diameter bore and an 18-inch stroke.

During this movement, the fingers (not shown) along both sides of the dies start to move inward and upward by cam and linkage movements. When the rear-axle housing leaves the die *D*, it continues upward on punch *E* while the fingers follow under the part to their extreme inward and upward position. Then the work is stripped from the punch by a positive knockout, into the waiting fingers. The carriages on which the fingers are mounted then advance to move the parts 18 inches in a horizontal plane. Simultaneously, the press ram continues to the top of the stroke and then begins its descent. At this point, the fingers start to retract, and, when the punches are 1/2 inch from the bottoms of their strokes, return horizontally to their starting positions.

A spring-loaded plunger *F* is kept in contact with limit switch *G* until the work has been raised from the die, at which point the plunger enters a slot in pin *A* and breaks contact with the limit switch—thus permitting indexing to proceed. Similar set-ups are employed at subsequent stations on this press, with the excep-

Fig. 4. Schematic drawing of transfer mechanism used on press seen in Fig. 2. Limit switches and solenoid valves control air cylinders for moving transfer bar.

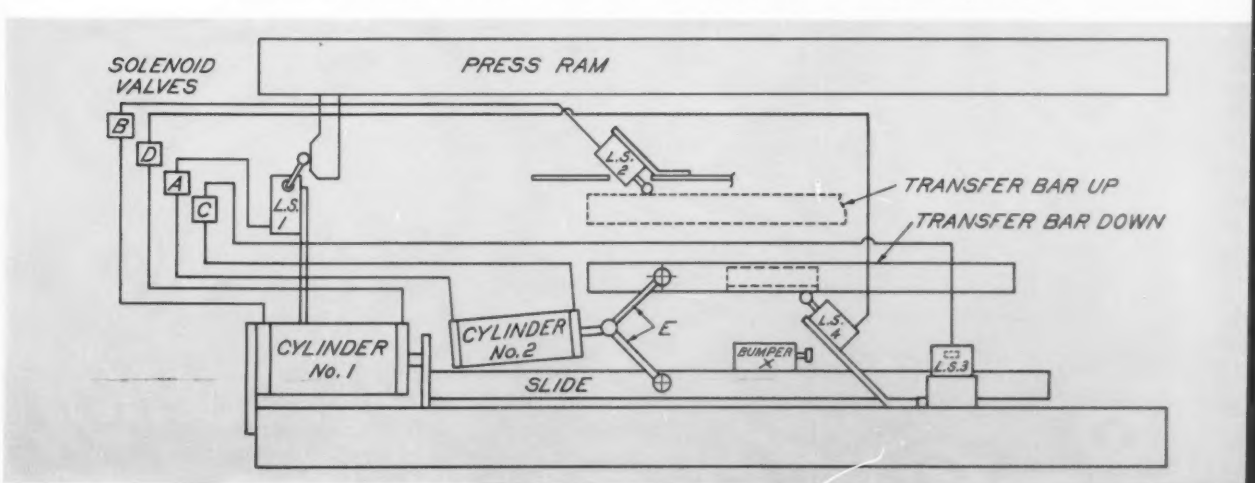
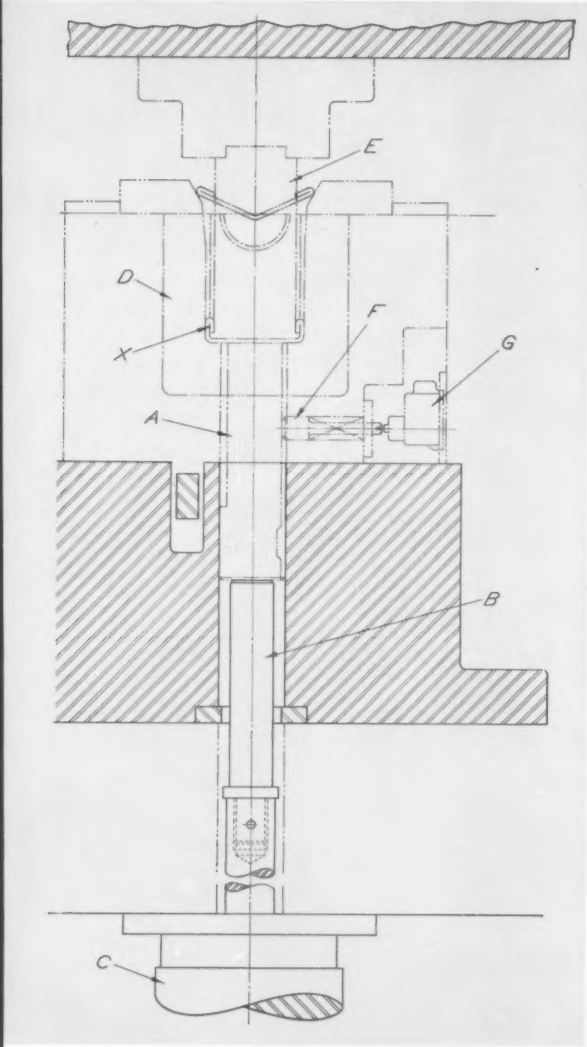


Fig. 5. Four-station, 2000-ton press, which is synchronized with and connected to preceding press by a work conveyor, U-forms, restrikes, and trims housings.



tion that only a 4-inch diameter air cylinder is required for lifting at the third station.

Rear-axle housings automatically unloaded from the fourth station slide down a chute onto a conveyor which carries them through a Centri-Spray jet type washing machine, seen at the right in Fig. 5. Here a mineral spirits metal cleaner, maintained at a temperature between 170 and 180 degrees F., is sprayed on the housings to remove all lubricant, dirt, or other foreign substance.

From the washer, the housings are conveyed to any of five Expert special seam welders for joining the upper and lower halves by the hidden or submerged arc method. The machines are equipped with four of Lincoln Electric Co.'s new LAF-3 automatic welding heads having individual controls, as seen in Fig. 7, and each completes a seam weld approximately 22 inches long, starting from the banjo section and continuing to the end of the housing. A 100 per cent weld penetration is specified for a distance of 1 1/4 inches from the banjo section, and 60 per cent for the remainder of the welds.

Considerable pressure is exerted on the housing halves by means of air cylinders and toggle clamps to prevent their expansion due to the heat of welding. The heads operate at 460 amperes and 26 volts, and travel at a rate of 60 inches per minute. Copper-coated welding wire, 1/8 inch in diameter, is supplied from reels by drive rolls, and the flux flows from nozzles and covers the

Fig. 6. Sectional drawing through first-station die on press seen in Fig. 5. Air cylinder (C) lifts work-piece (X) from die (D) to permit transfer to next die.

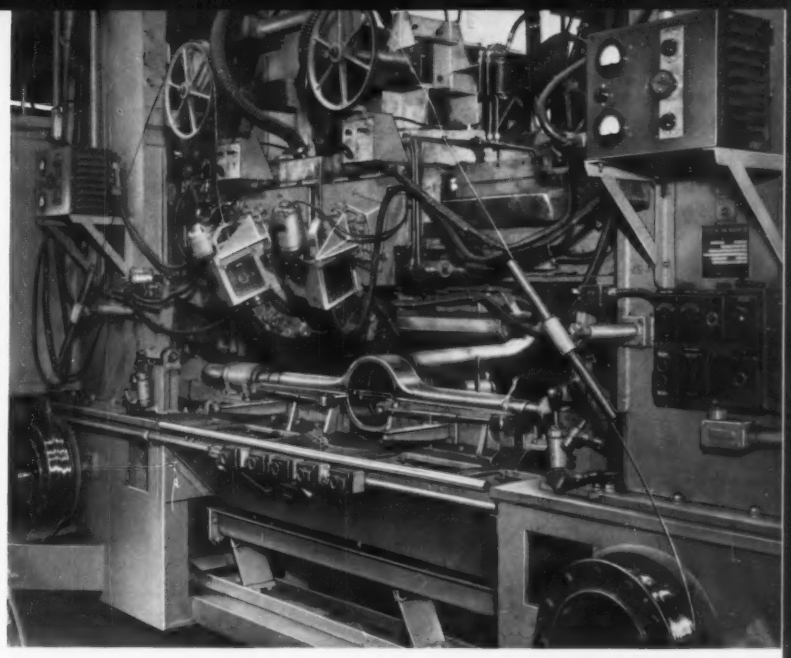


Fig. 7. Submerged-arc seam welder equipped with four heads for automatically joining the previously formed upper and lower halves of the rear-axle housings.

weld areas. Used flux enters a screen-covered hopper below the work and is carried to a reclaiming unit. One man can operate two welding machines.

Welded rear-axle housings are placed on hangers suspended from a chain conveyor and carried to a Toledo straight-side, double-crank press of 160 tons capacity. Here, excess weld material is shaved from eight locations on each housing—at both ends and adjoining the banjo section. Then, a Warco 1000-ton press is employed to coin both ends of the housing and flatten the banjo faces. In this same operation, two arc-shaped gear clearance slots, having a radius of 1.74 inches and a depth of 5/16 inch, are notched in the carrier face of the banjo section on each axle housing.

A sectional drawing of the cam-actuated notching portion of this die is seen in Fig. 8. The banjo section *X* of the housing is clamped against die-block *A* by spring-loaded ring *B* and located radially by buttons *C*. Punches *D*, which carry the two notching members *E*, are moved outward radially by contact with cam-block *F* as the press ram descends. When the press ram rises, punches *D* are moved inward to their

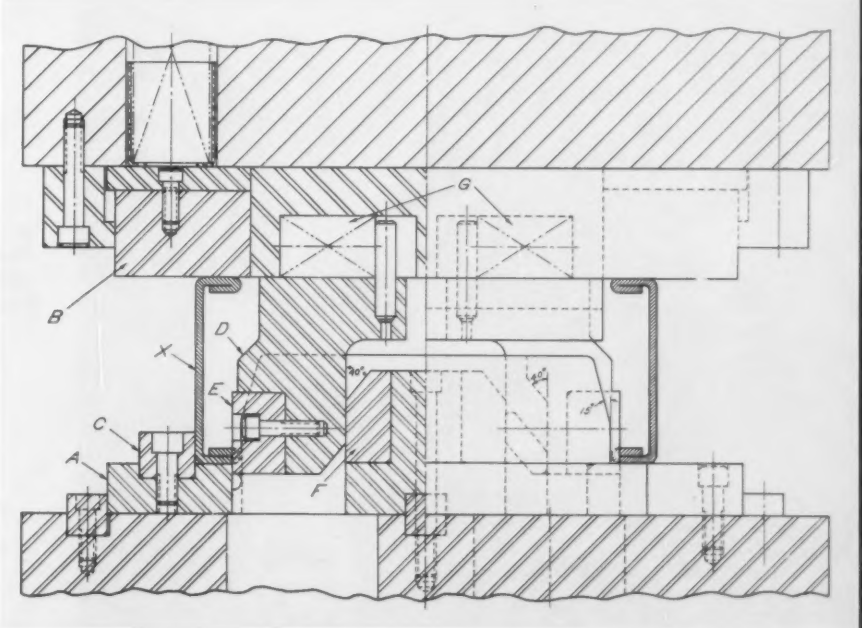


Fig. 8. Notching members (E) are forced radially outward as the press ram descends by contact of punches (D) with cam-block (F). Springs (G) return the punches.

starting positions by the action of springs *G*, thus clearing the opposite face of the banjo section.

Flanges, which are welded to both ends of each rear-axle housing, are blanked from 11/32-inch thick plates of deep-drawing quality, SAE 1008 steel, the plates being 16 5/8 inches wide by 80 5/8 inches long. Blanking is done three at a time on a Clearing 700-ton press which operates at thirty strokes per minute.

Forming of the flange blanks is performed on a six-station Verson Transmat press, Fig. 9, rated at 1200 tons capacity and operating at eighteen strokes per minute. Previous flange design required a deeper draw, and therefore necessitated a series of three progressive cold draws and piercing on one press, two hot draws on a second press, and then trimming on a third press. The new shorter flange can be completely formed, including cold extrusion and trimming, in one continuous operation on this single press.

Successive shapes produced in forming the flanges are illustrated from top to bottom in Fig. 10. Circular blanks are stacked in a three-station automatic feeder at one end of the transfer press. The blanks are separated magnetically and automatically lifted one at a time to the proper level for transfer into the press. When the stack of blanks at one station has been exhausted, the feeder is indexed one-third of a revolution to present another stack.

Transfer of the blanks from station to station is accomplished by horizontal bars extending along both sides of the press and equipped with work-gripping fingers. When the transfer bars automatically move together, in synchronization with the travel of the press ram, the fingers grip the work-pieces. Then the bars advance to transfer the parts to successive stations, and return to their starting positions.

At the first station on the transfer press, the blanks are rough-pierced to produce a hole approximately 1 inch in diameter, and formed into a saucer shape about 1 1/2 inches deep. The hole in the center of each part is enlarged to 1 1/2 inches in diameter by re-piercing at the second station. At the third station, the flange is cold-extruded between a high-carbon, high-chromium hollow die and a solid carbide punch. The fourth station is idle, and restriking for size and coining of the flange are done at the fifth station. A circular segment having a maximum width of 0.56 inch is trimmed from the flange periphery at the sixth station.

The flanges are washed in a machine similar to the one used for cleaning the housings, and are then conveyed to Agnew automatic machines, such as the one seen in Fig. 11, for welding a flange to both ends of each rear-axle housing. These submerged-arc seam welders are equipped with two Lincoln LAF-3 automatic welding heads having individual controls, wire drive rolls, and flux supply and recovery units. The heads operate at 500 amperes and 27 volts, with

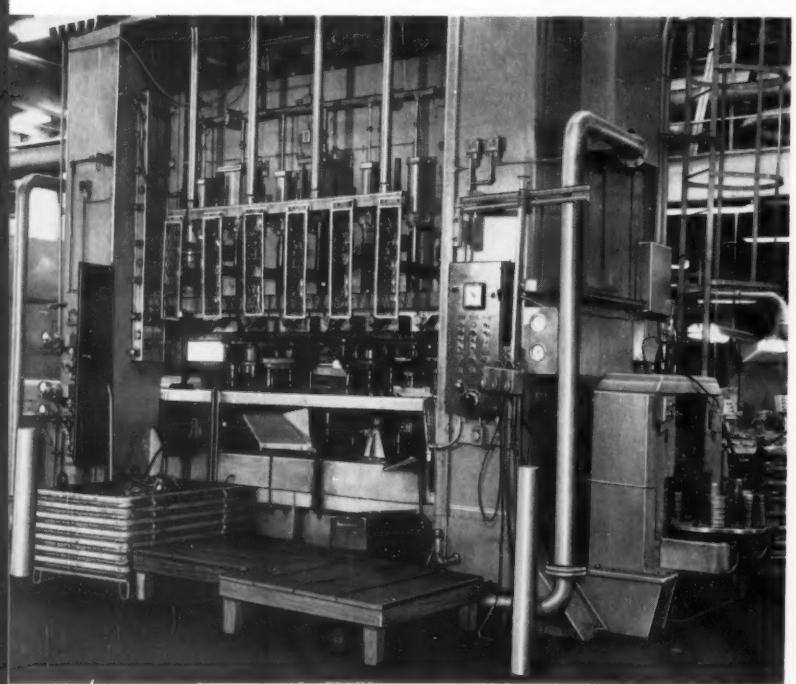
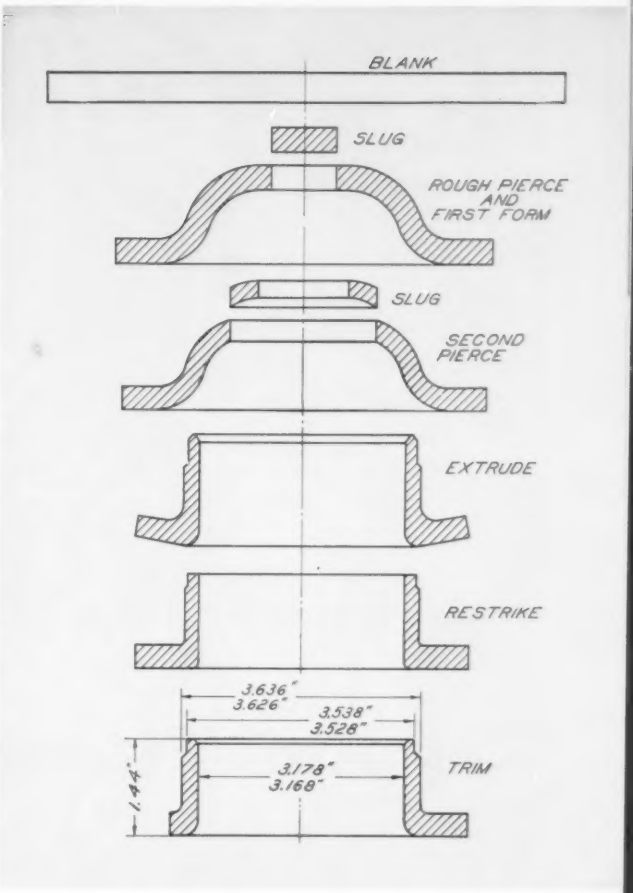


Fig. 9. Six-station transfer press of 1200 tons capacity is employed to pierce, form, extrude, restrike, and trim housing flanges at eighteen strokes per minute.

Fig. 10. Shapes progressively formed (top to bottom) in producing housing flanges. Cold extruding is done over a solid carbide punch at third station.



direct current being supplied from motor-generator sets. A collector operating at 10,000 cubic feet per minute removes welding fumes.

Positioning of the rear-axle housing for welding is accomplished with a locator block that enters the banjo section of the housing. A flange is manually placed in the fixtures provided at both ends of the machine. When the automatic cycle button is pushed, the flanges are pressed over the ends of the housing, the fixtures and locating block retract, the heads are lowered into welding position, and the work begins to rotate. The heads are angularly positioned to permit welding in the sharp corner formed between flange and housing. Rotation of the work prevents run-off during angular welding. Flux is scraped from the area of the initial weld to permit a slight overlap of the weld as the work continues turning beyond one revolution.

Welded housing assemblies are tested by sealing the ends and banjo openings with rubber pads, submerging in a water tank, and introducing air under a pressure of 6 pounds per square inch. If bubbles are detected, the housings are repair-welded. Then the housing assemblies are snag-ground to remove excess weld material and visually inspected prior to shipment.

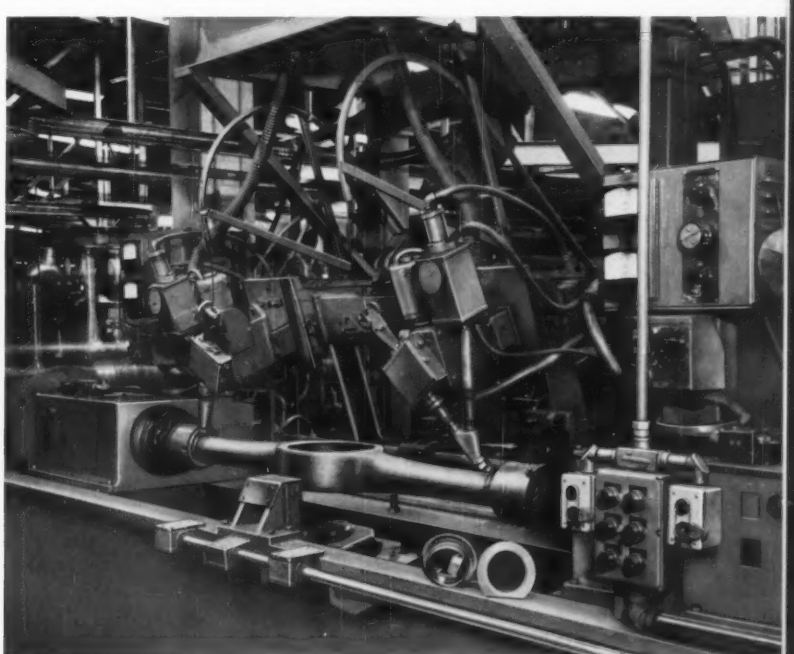
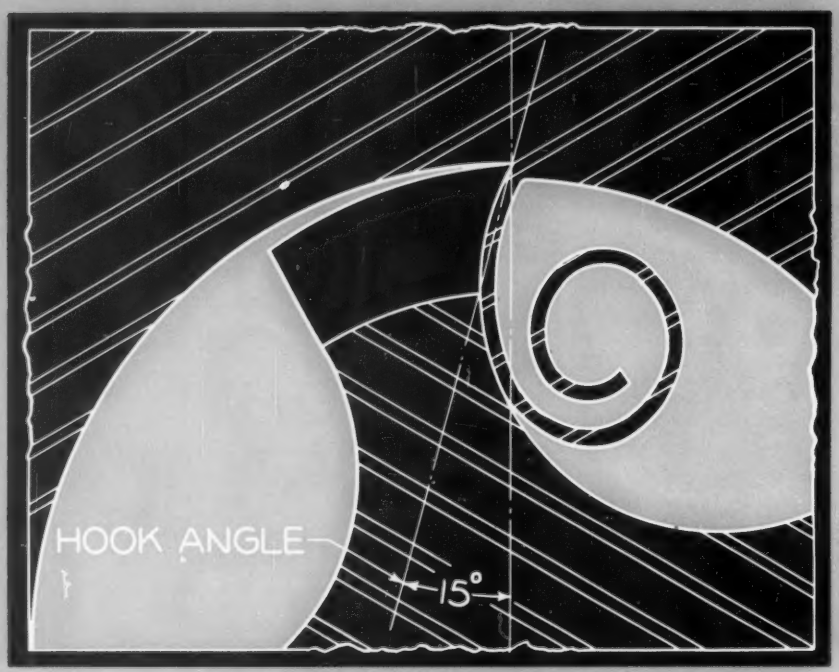


Fig. 11. Automatic submerged-arc seam welder for attaching flanges to both ends of rear-axle housings. Welding heads operate at 500 amperes and 27 volts.



Good shearing action is obtained with a 15-degree hook angle on straight-fluted taps of conventional design

Tapping Titanium Demands Special Consideration

By EARL COOK, Chief Engineer
Threadwell Tap & Die Co., Greenfield, Mass.

ALONG with the introduction of titanium to industry came the inevitable problems associated with the machining of a new material. In this respect, tapping was no exception. Considerable progress has been made, however, and data relating to the design and application of taps for titanium is given in the paragraphs that follow.

Unfortunately, the term "titanium" is being loosely applied to both the commercially pure metal and its alloys. Because of this, tap manufacturers are frequently requested to recommend taps and tapping procedures without specific reference to the type of metal to be worked.

There is a variation in machinability not only between commercially pure titanium and its alloys, but also between the individual grades of alloys. Experience has indicated that the presence of impurities, excessive carbon, or both, tends to give the alloys an undesirably abrasive effect on cutting tools. Therefore, the user can assist the manufacturer by giving more complete details about the type and composition of the metal to be tapped.

Chip Flow is an Important Factor

Because it has important bearing on performance, it should be pointed out that taps must perform under the inherent handicap of limited

chip flow. This fact is, to a large degree, responsible for poor performance. Since titanium produces a curling chip, it can be readily appreciated that adequate chip disposal is of extreme importance and must be given every consideration in tap design. It is also important that product designers avoid specifying threads in either "blind" holes or through holes of excessive length. In both cases the chips are confined and can contribute to rough threads and broken taps.

Galling Results from Excessive Heat

In addition to producing a curling chip, tapping of titanium causes a rapid temperature rise. Because this metal is a poor conductor of heat it has been found that minute particles of it become welded to the cutting edges and flanks of the taps. Sometimes termed "galling," this condition results in rough threads and over-size tapped holes because metal in excess of the normal thread profile is carried away.

When galling occurs, the normal friction developed during a tapping operation is increased, thus demanding a greater amount of torque to drive the tool. Any such increase in torque serves to distort the lead of the tap, thus further increasing the torque required and causing eventual tap breakage.

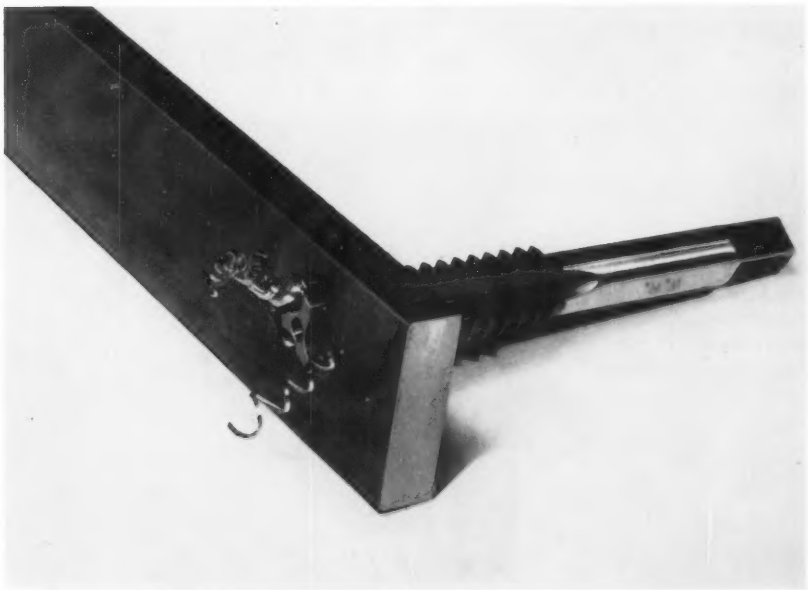
Galling can be controlled by supplying a copious flow of coolant, using sharp taps having proper cutting-face angles, and operating the taps at proper speeds. Carbon tetrachloride, being highly active, is one of the most successful tapping fluids. Unfortunately, it is toxic and therefore not practical. Sulphurized and chlorinated oils are recommended. Although taps should be kept sharp when used with any material, this is especially important when working with titanium. A close check should be kept on them so that they can be removed before becoming dull.

Performance of taps will be improved by using relatively slow speeds. Cutting speeds ranging from 40 to 50 feet per minute are recommended for commercially pure titanium, and from 20 to 40 feet per minute for its alloys. These speeds may have to be varied to suit individual conditions.

Tap Drills for Titanium

It has been the practice in industry for many years to specify tap drill sizes which, theoretically, produce approximately 75 per cent of a full thread. Various technical groups have proved by strength tests, however, that increases in thread depth over 60 per cent do not materially increase the strength of the thread. In many cases 55 to 65 per cent of a full thread is adequate. On the other hand, any increase in the percentage of a full thread greatly increases the tapping torque and can result in inferior thread quality, tap breakage, and high production costs.

Fig. 1. Spiral-pointed taps are preferred for titanium because they direct the curled chips forward and out of the hole.



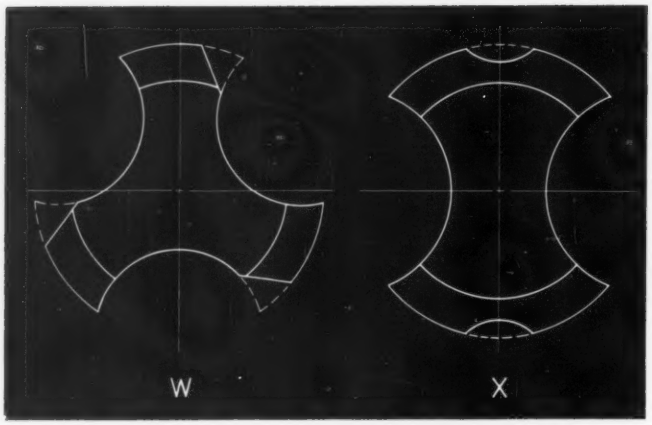


Fig. 2. Removing the trailing edge of the tap, W, and grinding an axial groove along each land, X, help to minimize thread flank contact.

It is advisable to specify the largest tap drill size possible, being consistent with the strength requirements of the assembled component.

Considerations in Tap Design

No presentation of the various factors which contribute to the successful tapping of titanium would be complete without the consideration of tap design. The necessity for adequate chip disposal and chip flow has been previously brought out. Proper tap design can be of help in this regard. A positive hook angle of approximately 15 degrees in conventional straight-fluted taps, as shown in the heading illustration, provides a good shearing action. It is also important to direct this shearing action in such a way as to propel the chips forward and out of the hole, as shown in Fig. 1. For this reason, spiral-pointed taps are recommended.

It should be realized that spiral-pointed taps cannot be expected to propel chips forward in holes that are more than two diameters long. Although there may be exceptions to this rule, the limitation can be used as a yardstick. It is also true that straight-fluted taps will fill with chips in deep holes and excessive torque will result. When using straight-fluted taps for 1/4-20 threads and smaller, the two-fluted type gives the best performance. For larger threads, the three-fluted type is recommended.

Standard taps have been modified in an attempt to minimize thread flank contact and to thereby reduce friction and its resultant heat. These modifications have been accomplished by grinding away the trailing edge of the tap, as shown at W in Fig. 2; by grinding axial grooves into the thread crests along the full length of the tap land, as shown at X; by using either an eccentric or a con-eccentric pitch-diameter relief, as shown at Y and Z, respectively, in Fig. 3; and also by employing interrupted threads, as illustrated in Fig. 4.

The many factors, or combinations of factors, that contribute to the success or failure of a tapping operation make it difficult to specify

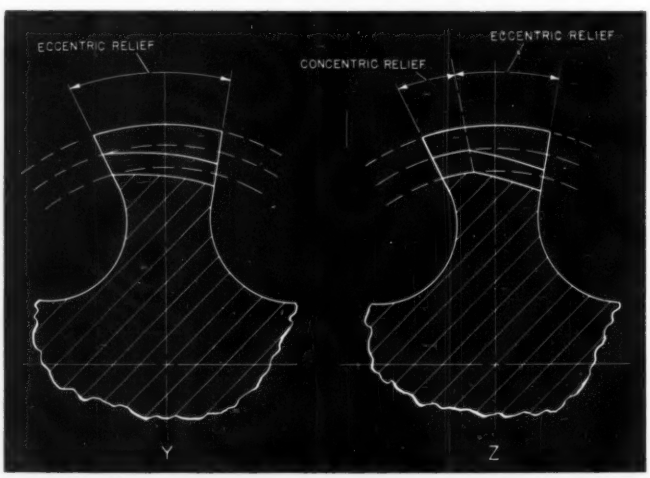


Fig. 3. Eccentric pitch-diameter relief, Y, or con-eccentric pitch-diameter relief, Z, assist in the reduction of friction during tapping operations.

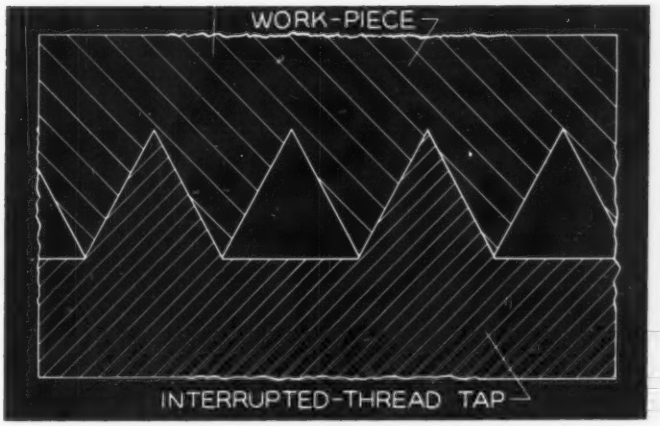


Fig. 4. Every second tooth is removed to form an interrupted-thread tap to decrease the rubbing action between the tool and the work-piece.

any given tap as the only type to use. Generally speaking, taps having the trailing edge ground away, those incorporating axial grooves the full length of the land, or taps with con-eccentric pitch-diameter relief have not been as successful with titanium as those featuring eccentric pitch-diameter relief with either full or interrupted threads.

Use of the eccentric type of pitch-diameter relief on a tap with full threads substantially decreases contact between the tap thread flanks and the tapped part. Heating and galling are, therefore, decreased. Considerable success has also been obtained through the use of spiral-pointed taps having interrupted threads and eccentric pitch-diameter relief. It is possible to obtain this combination of features in taps as small as No. 10-32 National Fine in the three-fluted type.

Proof of the efficacy of this design has been afforded by a test in which a tap incorporating these design features was compared to that of a conventionally designed tap. The test was conducted with a standard tapping device featuring rapid forward and reverse movements of the tap whenever torque in excess of a predetermined amount was encountered. In the course of the comparison tests on a titanium part, the tap of conventional design required an excessive amount of time to complete the operation and caused the tapping device to reverse repeatedly. When the three-fluted, spiral-pointed tap with interrupted threads and eccentric pitch-diameter relief was substituted, the tapping operation was completed without reversal of the tapping device.

Surface preparation and treatment of taps to be used with titanium can also contribute to the successful tapping of this material. Vapor blasting, nitriding, and the addition of oxides to the thread flanks have aided in the reduction of friction and galling and increased resistance to abrasion. As with any material, the successful tapping of titanium must be based on a knowledge of the machining characteristics of the metal, selection of good tapping equipment and fixtures, choice of proper speeds and coolants, and the use of a tap incorporating features which tend to minimize troublesome machining characteristics.

THE necessity of producing irregularly shaped prototype parts for new aircraft designs from large solid bars and blocks of aluminum alloy or steel often strains the imagination of shop men responsible for turning out work in this category. Forging dies are too expensive for such parts because of the small quantity required. The heading illustration shows a variety of components for hydraulic equipment that would ordinarily be forged if the quantity warranted, but which are produced more economically by Proto-Turning in the El Segundo, Calif., plant of the Douglas Aircraft Co., Inc.

In this process, which was developed by the Sidney Machine Tool Co., Sidney, Ohio, in conjunction with Douglas engineers, use is made of an engine lathe equipped with a Fluid Tracer and a high-speed milling head which drives a small rotating tool that resembles a die-sinking cutter. The cutting end is similar in contour to a stylus except for a single flute and cutting edge. The tool is driven by a high-speed motor designed by Douglas Aircraft engineers and mounted on the cross-slide of the engine lathe.

During an operation, the cross-slide moves in and out under the control of the stylus on the Fluid Tracer as the stylus follows the conformations of a rotating template of wood or metal mounted between centers at the rear of the lathe bed. During these forward and retracting movements, the rotary cutter is in contact with the work so that the latter is machined to the same contours as the template.

The cutter-head driving motor operates at the rate of 360 cycles on 220-volt current, which gives it a speed of 21,500 R.P.M. The motor has a rating of 7 1/2 H.P. even though its dimensions are approximately those of a 3-H.P. motor of the high-cycle type. The compact design has been made possible by a unique dual cooling arrangement.

At the top in Fig. 1 is shown an aluminum bar that has been turned down eccentrically between two rough sections and also at the left of the one unturned portion. The turning was performed in conventional manner on an engine lathe and was a preliminary step in making an actuating cylinder. The original solid bar was approximately 3 1/2 inches in diameter by 30 inches in length.

One of the problems to be solved on this job was how to produce the several projections and slots on the two ends of the actuating cylinder. The job was accomplished by Proto-Turning on the Sidney lathe shown in Figs. 2 and 3.

Close-up views of the cutter-head and cutter are shown in Figs. 4 and 5, in which Proto-Turning is being performed on a comparatively short part having several lugs and protuberances. The arrangement of the template at the back of the lathe will be apparent from Fig. 4. The template revolves at the same speed as the lathe spindle.

ROTARY CUTTERS used in Proto-Turning

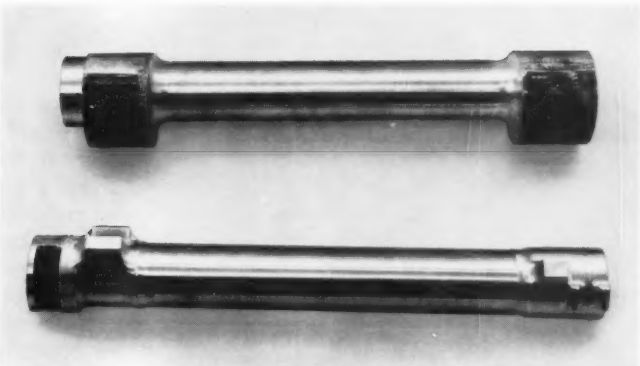


Fig. 1. (Left) An aluminum bar that was first turned down eccentrically, as shown at the top, and then Proto-Turned to form several lugs on both ends, as seen in bottom view.

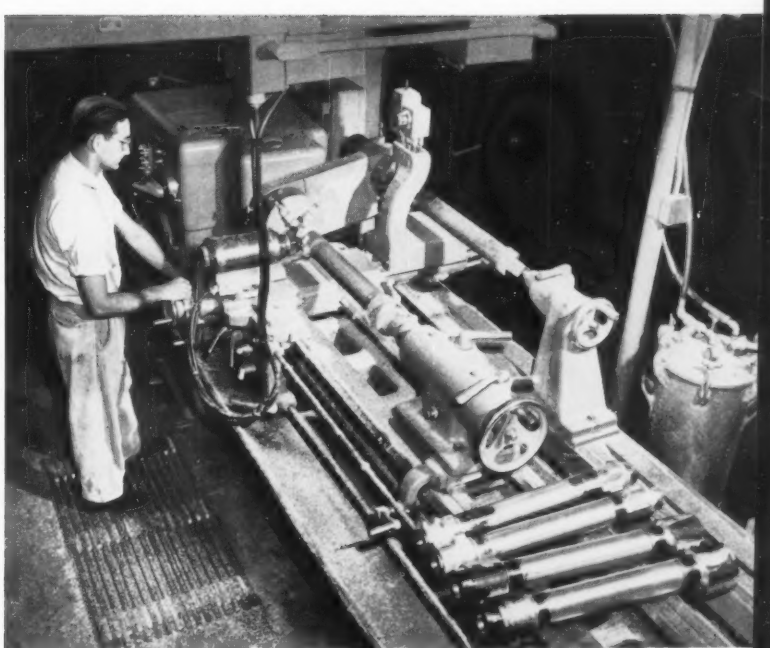


Fig. 2. (Right) Lathe equipped with a Fluid Tracer and a special cutter-head that drives a revolving tool for short-run production of aluminum aircraft parts.

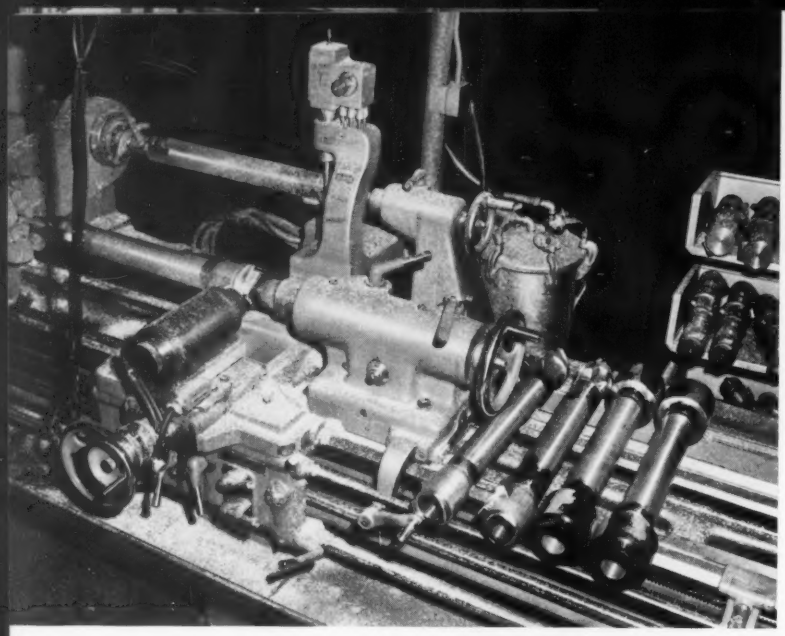


Fig. 3. Close-up view of the set-up on lathe seen in Fig. 2 for machining an actuating cylinder from a bar originally 3 1/2 inches in diameter by 30 inches long.

Oil mist is used as the cutting coolant in Proto-Turning operations. The oil is circulated through a spiral groove in the outer case of the cutter-head motor before being ejected on the cutter and thus it carries away generated heat. Another stream of oil mist is directed through the bearings at one end of the motor, through an air gap, and then out through the bearings at the opposite end, thus dissipating heat from within the motor itself. Dynamic braking is provided to stop the motor within four to ten seconds.

In Proto-Turning, dimensional tolerances as close as plus or minus 0.002 inch can be held with ease. A speed reducer cuts the conventional spindle speed for this work, there being a clutch mechanism that permits disengagement of the speed reducer when the lathe is to be employed for other work. The flexibility of the equipment readily adapts it to the production of odd-shaped parts in small quantities because change-overs necessitate only a substitution of different templates.

Fig. 4. (Center) Turning a comparatively short component with several lugs and other protuberances. The Fluid Tracer and template are clearly seen at the back of the lathe.

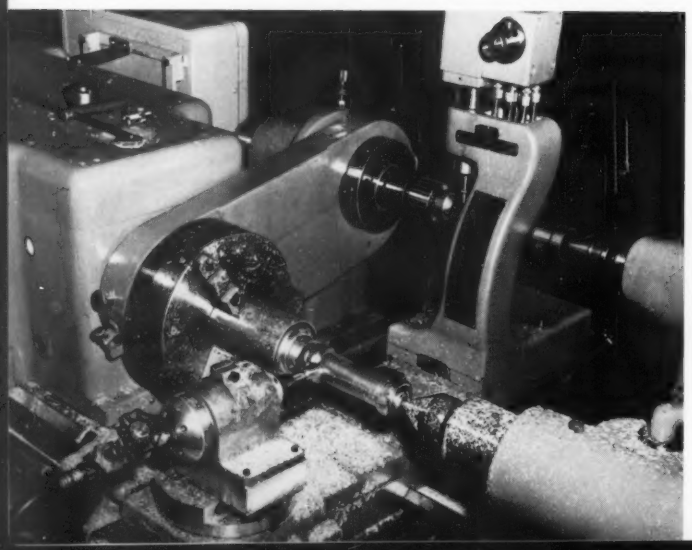
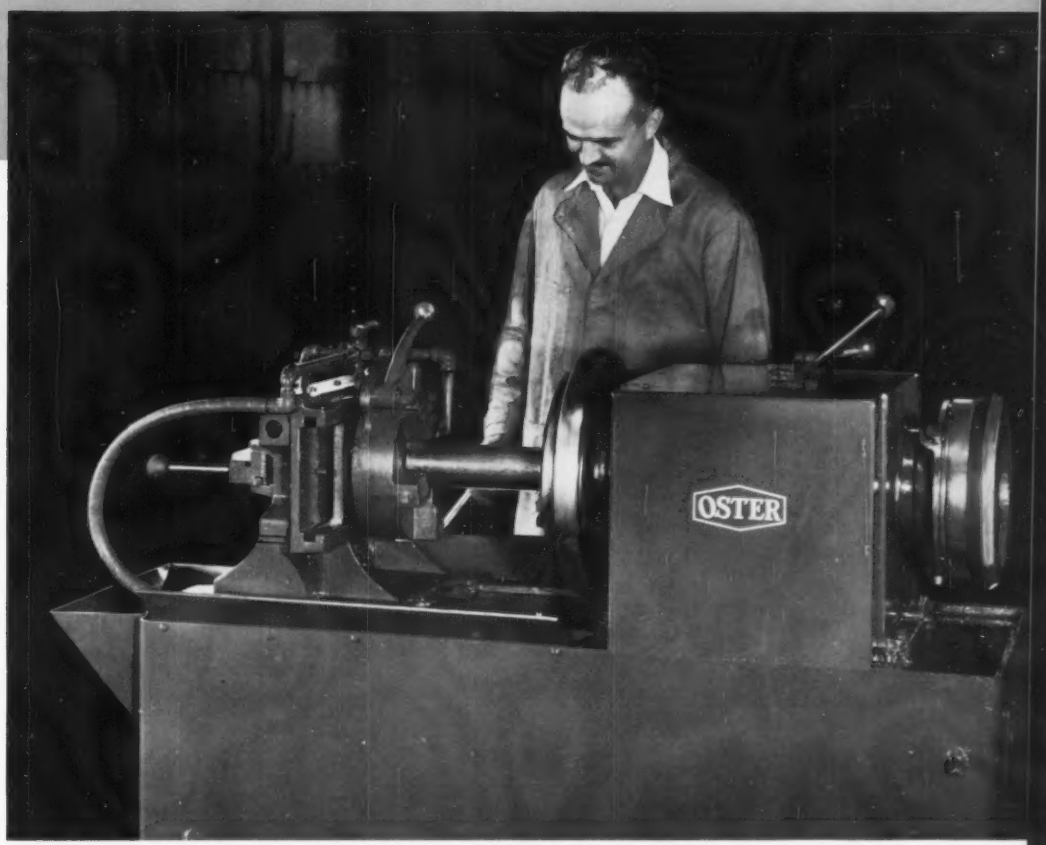


Fig. 5. (Left) In Proto-Turning operations such as here shown, the cutter revolves at a speed of 21,500 R.P.M., driven by a 7 1/2-H.P. motor.

How much torque is needed for threading bolts and pipe?

By R. J. MARTIN, Chief Engineer
Oster Mfg. Co., Cleveland, Ohio



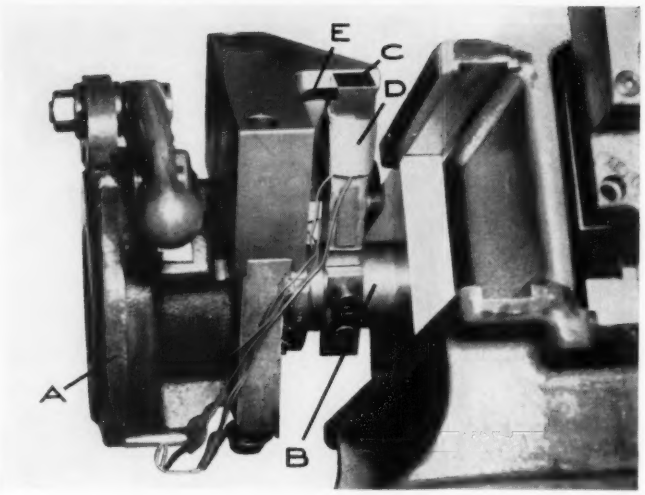
THREAD-CUTTING, although a commonplace phase of production, is a severe metal-working operation. In spite of this, little effort has been directed toward determining the amount of torque necessary to successfully carry out threading procedures; consequently, little information has been made available.

One of the few articles presented on this subject concerned the power consumed by self-opening die-heads while cutting the American Standard thread form. The article (MACHINERY, November, 1932, page 210) dealt with the results of tests performed by the Eastern Machine Screw Corporation, New Haven, Conn. From the tests, the following conclusions were recorded:

1. Torque varies directly as the diameter for threads of equal pitch.

2. Torque varies as the square of the pitch for threads of equal diameter.

3. Torque varies inversely as the machinability of the work-piece material.



Standard manually opened die-head is supported on a special mounting for determining the torque required for threading. Strain gages (D) are secured to torque-arm (C)

Table 1. Torque Required for Cutting American Standard Screw Threads

Thread Diameter, Inches	Threads per Inch	Measured Threading Torque, Pounds-Feet	Calculated Threading Torque, Pounds-Feet*
1/4	20	2.9	2.2
1/4	28	1.5	1.1
5/16	18	3.6	3.4
5/16	24	2.0	1.9
3/8	16	5.4	5.1
3/8	24	2.4	2.3
7/16	14	8.5	7.8
7/16	20	4.9	3.8
1/2	13	11.0	10.4
1/2	20	5.5	4.4
9/16	12	14.2	13.7
9/16	18	6.4	6.1
5/8	11	18.0	18.0
5/8	18	6.7	6.8
3/4	10	30.5	26.3
3/4	16	12.0	10.3
7/8	9	35.5	37.8
7/8	14	15.5	15.6
1	8	47.0	54.7
1	14	19.0	17.8
1 1/8	7	76.0	80.4
1 1/8	12	27.0	27.4
1 1/4	7	80.0	89.3
1 1/4	12	32.0	30.4
1 3/8	6	114.0	134.0
1 3/8	12	36.0	33.4
1 1/2	6	136.0	146.0
1 1/2	12	40.0	36.5
1 3/4	5	236.0	245.0
2	4 1/2	322.0	346.0

* Calculated torque values were computed from the formula $T = \frac{3500\,D}{n^2}$

This is the same formula that is given in the text, but with the constant 3500 being experimentally derived for AISI C1117 steel.

4. Torque required by dull chasers ranges up to 200 per cent more than that required by sharp chasers.

These past tests have been expanded recently through a project carried out by the Oster Mfg. Co., Cleveland, Ohio. A conventional 2-inch capacity threading machine was equipped with standard hobbed type production dies mounted in a standard, manually opened die-head. "Best-oil" cutting fluid was used throughout the procedure. Tests were limited to bolt and pipe threads ranging up to 2 inches in diameter.

The specially rigged die-head mounting is shown in the illustration. Die-head *A* is supported by an anti-friction bearing on the end of a short beam *B*. A torque-arm *C* with strain gages *D* attached is fixed to beam *B*. On the die-head is screwed a block having a knife-edge *E* which contacts the torque-arm.

At the start of these tests, two previously mentioned points seemed evident: first, the torque should vary directly as the diameter; second, the torque should vary as the square of the pitch. The first point was based on the assumption that the force required to remove the metal in forming a thread of given pitch is constant. This was substantiated by the data accumulated as the tests progressed.

The second point was based on the fact that torque is proportional to the volume of metal removed. It was unmistakably shown that the volume of metal removed is proportional to P^2, where P represents the pitch.

Bolt threads were cut on bars of AISI C1117 steel, which has a machinability rating of 90 per cent. Tests run on 1 1/4-inch diameter bars, however, were duplicated on bars of B1112 steel, which has a machinability rating of 100 per cent. Torque required to thread the B1112

Table 2. Torque Required for Cutting American Standard Taper Pipe Threads

Thread Diameter, Inches	Threads per Inch	Threading Torque, Pounds-Feet
1/4	18	20.0
3/8	18	25.0
1/2	14	40.0
3/4	14	50.0
1	11 1/2	90.0
1 1/4	11 1/2	115.0
1 1/2	11 1/2	140.0
2	11 1/2	204.0

steel bars was approximately 90 per cent of that required for the C1117 steel. From this limited amount of data, it is apparent that the torque required for threading is inversely proportional to the machinability rating of the material being cut.

Results of tests with pipe threads brought out several interesting points. Threads cut under size did not show an appreciable increase in required torque; however, the torque reached its maximum value more rapidly. There was found to be no difference in the torque required to thread black pipe as compared to galvanized pipe. The apparent difficulty in threading galvanized pipe is frequently due to its unsatisfactory gripping quality.

It was also found that a straight pipe thread, cut with straight-thread dies, requires only 72 per cent of the torque needed by the same thread formed with jam-cut dies. With straight-thread dies, all of the cutting is done by the throat and first tooth, while with jam-cut dies, cutting takes place along the full width of the die. Even though the chip load per tooth is less on a jam-cut die, there are so many teeth cutting simultaneously that the required torque increases.

The number of threads per inch on all pipe sizes ranging from 1 to 2 inches in diameter is 11 1/2. Therefore, if the test results were to follow the same pattern as that for bolt threads, the torque should be proportional to the diameter. This was not so, however, as the torque increased at a much greater rate. An explanation of this deviation lies in the thread length. A standard taper thread on a 2-inch diameter pipe is longer than a standard taper thread on a 1-inch diameter pipe; therefore, the length of cut increases, adding to the torque required.

The fact that threading torque is proportional to bolt diameter and the square of the pitch makes it possible to calculate torque values for other combinations of these variables. This can be done by applying the formula:

$$T = \frac{kD}{n^2}$$

where

T = threading torque in pounds-feet;
D = outside diameter of the thread in inches;
n = number of threads per inch, and
k = experimentally determined constant (3500 for the steel used in this test).

Torques calculated with this formula are compared with measured values in Table 1. Examination of the table will show that the majority of calculated torques are within 10 per cent of the measured torques. It can be expected that combinations of pitch and diameter other than those shown in the table will exhibit the same degree of consistency,

Torque values for taper pipe threads are presented in Table 2. Because taper pipe threads are jam-cut, this table cannot be extended in the same way as the table for screw threads.

Elimination of one or more hole-finishing operations can be instrumental in cutting the cost of producing accurate holes. Some recent developments in tool design aimed toward this end should be of immense general interest

Courtesy, Douglas Aircraft Co., Inc.

Producing Accurate Holes

By CARL J. OXFORD, Jr., Research Engineer
National Twist Drill & Tool Co., Rochester, Mich.

STRINGENT specifications are being applied to an increasing percentage of the holes produced by the metal-working industry. These requirements apply not only to the size, but also to the roundness and straightness of the holes—the degree of accuracy being dependent on the product design. Conventional manufacturing procedure would call for drilling followed by such finishing operations as reaming, boring, broaching, or honing. Multiple operations are costly. Elimination, or at least simplification, of some of them can result in noticeable savings. Considerable study of hole-producing and hole-finishing tools has been made by the National Twist Drill & Tool Co., Rochester, Mich. The results of several such studies are here reviewed.

Double-Margin Twist Drills

Each of the lands of a standard twist drill has one margin on its leading edge that serves to guide the tool in the hole being drilled. This can be seen at (A) in Fig. 1. The double-margin type of twist drill has been developed from this standard tool.

Double-margin construction, illustrated at (B), incorporates a secondary margin on the trailing edge of each land. These secondary margins are located approximately midway between the primary margins, thus providing four guide points. This results in greatly improved operational stability of the drill, both in the guide bushings and in the hole.

In the past, the principal use of double-margin drills has been to reduce sidewise deflection of the tool when drilling off-center cross-holes or wherever similar interruptions were encountered. In these applications, the additional margins held the drill on its true course during the time that the cutting forces were unbalanced due to the primary margins jumping across the interruption in the work surface.

Along with improved straightness, the double-margin drill also yields a more uniform hole

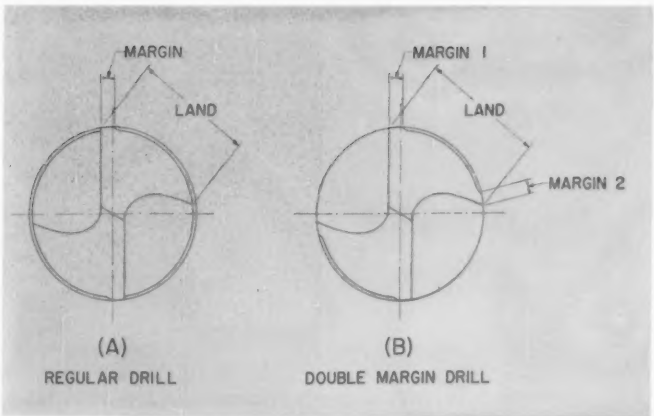


Fig. 1. End view of a conventional twist drill (A) and a double-margin twist drill (B) showing the difference in construction. The use of double margins provides four-point support of the tool.

size. This is because the improved guiding of the extra margins reduces the effect of inaccurate drill pointing. The aircraft industry has made use of this feature in drilling accurate holes for high-strength rivets and other fasteners, and for fluid-tight riveted joints.

Even when conventional drills are guided by bushings supported in fixtures, it is difficult to hold a 0.003-inch limit on hole size. Double-margin drills, guided by bushings, can easily hold this tolerance. The diameters of the drills in this case are relatively small—ranging from 0.080 to 0.500 inch. When used in a portable machine, these drills are generally sharpened to a split (crankshaft) point to reduce end thrust.

Double-Margin Step Drills

There are many places in aircraft structures where accurate holes are required but where the use of a guide-bushing plate is not feasible. Past practice in such cases has required the following procedure:

1. Drilling a small pilot hole.
2. Enlarging the hole with a piloted step drill.
3. Finishing the hole to size with either a piloted core drill or a piloted reamer.

Such holes can be produced in a single operation with a double-margin step drill of the type shown in Fig. 2. A pilot-drill step, ground on the point end, forms a guide hole in the work and serves to steady the tool while the double-margin portion finishes the hole to size. Ordinarily, the pilot diameter of these drills is not relieved, Fig. 3, so as to provide better guiding action. However, relief can be incorporated in cases where galling is encountered. In several cases, including both free-hand and power-feed drilling, holes not more than 0.002 inch larger than the drill size have been produced by these drills. Here again, a split point was used to minimize end thrust.

The double-margin drills described do not usually cut as close to their own size as do reamers. They do, however, form holes that are considerably closer to the intended diameter than would be obtained with conventional twist drills. Therefore, they are useful tools for holding intermediate hole size tolerances.

Gun Drills

Because of their ability to produce holes that are straight and accurately sized, single-flute gun drills are considered to be deep-hole tools.

Fig. 2. A straight-shank, double-margin step drill used for producing accurate holes when guide bushings cannot be utilized. For improved guiding action, the pilot diameter usually is not relieved.

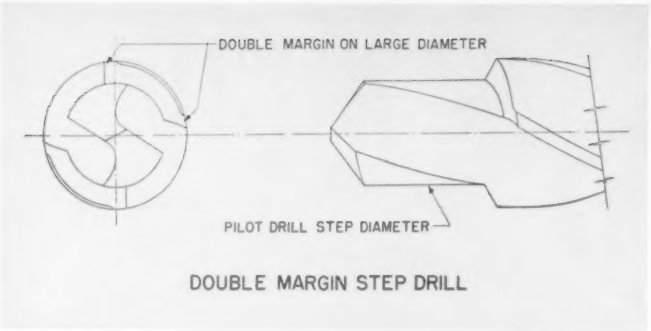


Fig. 3. Double margins on the main body of this step drill and the absence of relief on the pilot diameter are clearly shown. If galling becomes a problem, however, the pilot diameter can be relieved to reduce metal-to-metal contact.

They have also been employed successfully for cutting short holes. These holes are often found to be so accurate that finishing operations such as reaming, boring, and broaching can be eliminated.

When gun-drilling short holes, it is usually more convenient to rotate the drill rather than the work-piece. This simplifies fixture design and facilitates loading and clamping. An accurately running spindle and close alignment between the spindle and the guide bushing are essential. Contact between the guide bushing and the work-piece should be maintained so that the cutting fluid and the chips will flow out through the bushing. The bushing must also fit the drill head closely to insure accurate entry of the inherently unbalanced drill into the work.

Various types of machines have been adapted to this class of work. Small single- and multiple-spindle precision boring machines are particularly suitable for such conversions. Both "Target" (trepanning) and center-cut (conventional) gun drills, as shown at the right and left, respectively, in Fig. 4, can be used. The Target type usually will produce a more accurate hole, but when used on high-production runs, it sometimes introduces a problem of core removal and disposal. Since large quantities of cutting fluid are supplied under high pressures, ranging from 300 to 1000 pounds per square inch, adequate splash guards or enclosures must be provided on the machine. An uninterrupted flow of the cutting fluid is necessary to insure a good hole finish.

In Fig. 5 can be seen an automotive component shaft (cut in half for illustrative purposes) that was turned from AISI B 1113 steel. A hole 0.284 inch in diameter has been drilled lengthwise through the part with a center-cut gun drill having a solid carbide head. The drill was rotated at a speed of 3200 R.P.M. with a feed of 0.0008 inch per revolution. Total drill feed length was 4 1/2 inches. Cutting fluid was delivered to the tool at a rate of 30 gallons per minute.

Concentricity and straightness were maintained, and the hole finish is comparable to that obtained by reaming. In some steels, and in many non-ferrous alloys, it is possible to produce gun-drilled holes having a surface roughness of less than 25 micro-inches r.m.s.

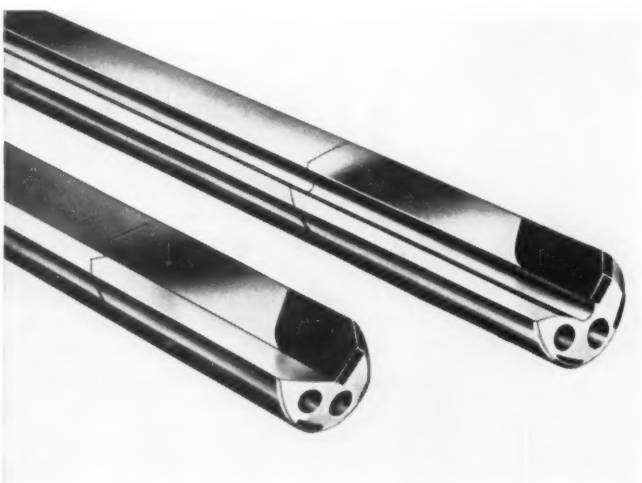


Fig. 4. Cutting ends of a center-cut (conventional) gun drill, left, and a Target (trepanning) gun drill, right. When properly used, these drills can produce straight, accurate holes having low values of surface roughness.

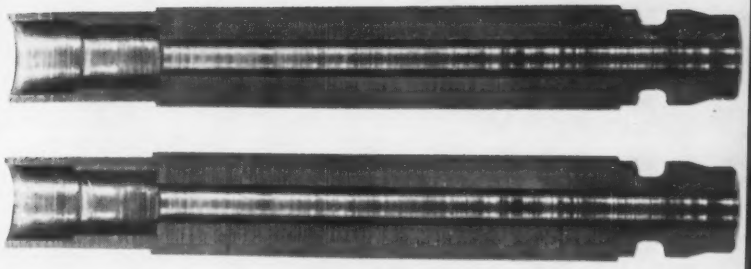


Fig. 5. This automotive component shaft has been cut in half to expose a 0.284-inch diameter hole that was gun-drilled through the length of the part. The 4 1/2-inch long hole has a finish comparable to that obtained by reaming.

Gun Reamers

A further development of the gun drill is the gun reamer. Like the drill, the reamer is a single-fluted tool. Cutting fluid is supplied through the tool shank and is introduced at the rear of the reamer head so as to reach the cutting zone and wash the chips forward and through the hole being finished. This type of tool, which is usually made with a carbide reaming head, is shown in Fig. 6. Because of the small amount of stock removed, cutting forces are also small. As a result, accurate hole size and good surface finish are obtained.

Gun-reaming has been successfully applied to the finishing of integral valve guides in the cylinder heads of modern overhead-valve automobile engines. One such set-up is illustrated diagrammatically in Fig. 7. The gun reamer is mounted in line with a valve-seating cutter to insure concentricity between the valve seat and the valve guide. Each of the tools is operated at different rotational speeds and at different feed rates. In the case shown, the reamer is rotated at a speed of 3600 R.P.M. and is advanced into the cast-iron cylinder head at a rate of 14 inches per minute. A flow of coolant is directed to the cutting zone under a pressure of 75 pounds per square inch.

Examples cited here are only a few of the recent advances in accurate hole production techniques. These tools are not cure-alls, and all require careful individual engineering for their successful use. When this is done, the cost of producing accurately sized and formed holes can be reduced considerably.

Fig. 6. A gun reamer of this type, having a solid carbide head, is used for finishing valve guides as shown in Fig. 7. Cutting fluid is directed to the cutting head through a hole in the tool shank.

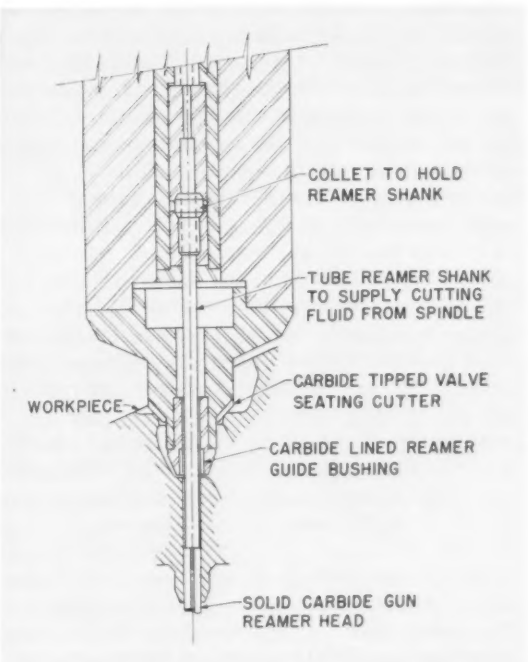

COLLET TO HOLD REAMER SHANK
TUBE REAMER SHANK TO SUPPLY CUTTING FLUID FROM SPINDLE
CARBIDE TIPPED VALVE SEATING CUTTER
WORKPIECE
CARBIDE LINED REAMER GUIDE BUSHING
SOLID CARBIDE GUN REAMER HEAD

Fig. 7. Set-up used for machining valve seats and gun-reaming integral valve guides in automotive cylinder heads. After the valve seat is finished, the cutter is retracted slightly, spindle speed is increased, and the gun reamer is fed through the valve-guide hole.

Precision to a Fraction of a Light Wave

By M. S. HOSKINS, Metrologist
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INTERFEROMETRY — measurement by light wave—is the culmination of the search for perfection in dimensional standard control. Many forms of measurement have been contrived through the ages in an effort to achieve some degree of standardization. The cubit, the length of the forearm of a male adult from elbow to middle-finger tip, was employed by Noah in building the Ark, and by the Egyptians in building the pyramids. The same unit also was used in ancient Greece and Rome.

Today's gage-blocks, descendants of the cubit, hold the key to the dimensional conformity and parts interchangeability vital to mass production. Precision items that they are, gage-blocks must be well calibrated in the first place to an accuracy above and beyond the tolerances demanded of the tools they are to govern. Since they are affected by wear and by physical and atmospheric conditions, the blocks themselves are subject to constant surveillance for accuracy. In fact, infinitesimal variations can be far more troublesome than the wide variations in the cubit, where, for example, human anatomy would prescribe a cubit in Egypt nearly a fifth again as long as the one in Rome.

A perennial problem has been to define the unit of measurement—be it the cubit, foot, inch, or meter—by some known standard that is constant and unchanging under all conditions. Such a standard was discovered at last some years ago in the light wave.

When the late Albert A. Michelson, distinguished American physicist and Nobel prize winner, invented the interferometer, he was concerned primarily with a device that would detect changes of velocity in light waves due to the motion of the medium through which they pass. As early as 1892, however, Professor Michelson discovered that his interferometer had a more important use. It was capable of defining the inch to an accuracy of one millionth.

The standard gage-block, moreover, by its general size, shape, and reflective quality, is ideally suited to the use of the interferometer for minute inspection and calibration. Thus it is possible today to be assured of a measurement standard as exact and as permanent as the characteristics of light.

Here is where interferometry comes in—but how can it be used? How are the wave lengths of light applied to measure a precisely finished block of metal? Answers to questions like these form the basis of current research and operations at the Sheffield Corporation's new Eli Whitney Metrology Laboratory opened this February in Dayton, Ohio. (A description of the laboratory appears elsewhere in this issue.)

The interferometers used in the laboratory are basically instruments in which interference fringes are formed by dividing a light beam of known wave length into two paths. These paths are then reunited after one has been reflected from the two planes under examination. The comparative spacing of the fringe pattern registered by the two planes minutely reflects the distance between them in terms of the known wave lengths of the light source employed, thus giving the dimension of the gage-block tested to an accuracy approaching 1/1,000,000 inch.

Such results are obtained by the Zeiss Koesters absolute interferometer and the Opton absolute and differential interferometer used in the Eli Whitney laboratory. Light sources such as cadmium, helium, krypton, and mercury 198 are employed by the interferometers. In the heading illustration, the Zeiss instrument is shown being set up to obtain absolute measurement of a 2-inch master gage-block to an accuracy of 1/1,000,000 inch.

A more simple type of interferometer, consisting merely of an optical flat and an ordinary light box, can serve to illustrate the light-wave interference phenomenon and how it is used to

evaluate gage-blocks for flatness and parallelism as well as for size.

Light, like sound, travels in a wave motion, and the wave-length measurement, determined by spectroscopic means, is the distance from one undulation to the next. (See Fig. 1.) When two or more rays or beams of light are flowing parallel or just slightly out of phase, one to the other, intensified illumination results.

But when two rays of monochromatic light flow exactly opposite to each other, so that the crest of one is above the valley of the other, absence of light or cancelling occurs. It is this absence or cancelling that causes the interference fringe, which is produced at intervals equal to one-half the wave length of the light source employed. (See Fig. 2.) Thus, the fringe stripes formed are spaced according to values of exactly one-half the wave length, and since the value of the wave length is known to at least the twelfth decimal place, or the trillionth of an inch, fringe spacing is known to the same decimal place.

The cadmium red wave length—which, incidentally, has been accepted internationally as an alternative standard for all linear measurement—is 0.00002534838828 inch under specified conditions. On that basis, the fringe spacing for cadmium red is 0.00001267419414 inch, although present techniques of interferometry limit its application accuracy to 1/1,000,000 (0.000001) inch.

All this, of course, refers to monochromatic light, or the light of a single color or wave length. Since there is no known light source that emits only one color or wave length, either a filter or a prism must be placed in the light path to obtain separate wave lengths and fringe spacings of the accuracy mentioned. This is one of the main differences between a simple optical flat with ordinary light and the more complex interferometers.

The light sources that can be used have varying numbers of component colors, or monochromatic wave lengths, and some offer special advantages in metrology. Cadmium, for example, is made up of three colors—red, green, and blue—and will give distinct fringe patterns on two surfaces separated to a distance of 4 inches. Helium is made up of six colors—red, yellow, green, blue-green, blue, and violet—and will give fringe patterns on two surfaces 1 inch apart. These fringe patterns, however, are too indistinct to be used for computation, so with this light source, the workable range is reduced to about 1/2 inch.

Mercury 198, on the other hand, has four colors—two yellows, green, and violet—and will

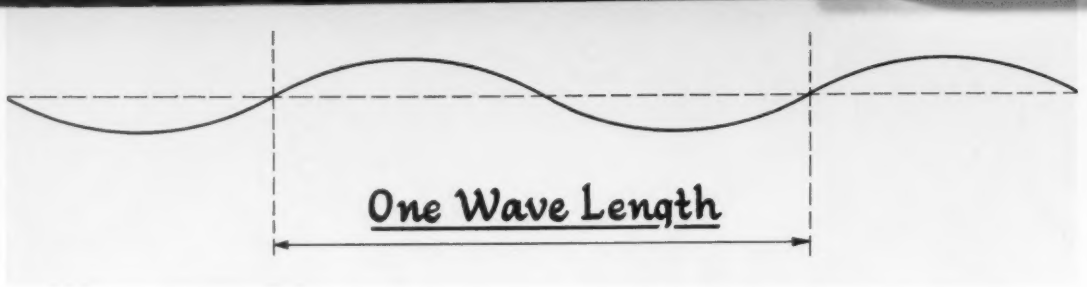
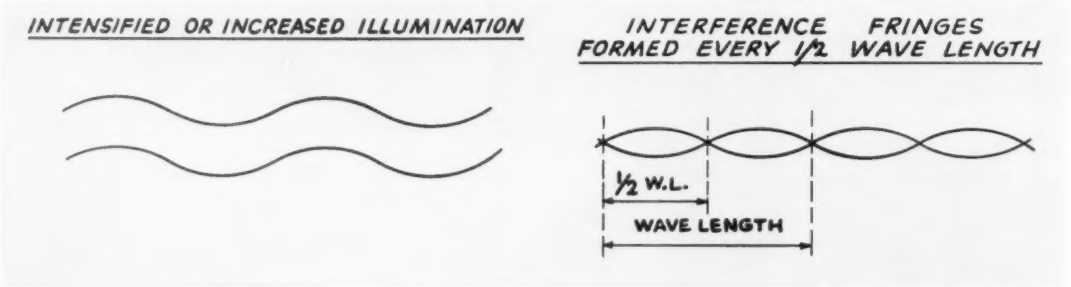


Fig. 1. (Above) A wave length is the distance from one undulation to the next.
Fig. 2. (Below) Parallel rays intensify illumination, opposing rays reduce it.



give fringe patterns for two surfaces separated to a distance of 18 inches. It should be noted that the red, green, and blue of cadmium do not have the same wave-length values as the red, green, and blue of helium, or the green of mercury 198. These characteristic differences in wave lengths of similar color are actually used, in other instances, to identify the element source of light.

For example, the wave length in millionths of an inch for one source of cadmium red is 25.34838828, and for a red radiation of helium is 26.292010. A comparison of a green of helium with a green of the isotope of mercury 198 shows wave-length values of 19.746818 and 21.49909874, respectively, in millionths of an inch. Naturally, the fringe spacings, being equal to one-half the distances, differ correspondingly.

So much for the first use of interferometry with respect to gage-blocks—to determine precise measurement between two parallel surfaces of the gage. A second use—to provide a contour map of microscopic surface irregularities and faults—is simply an application of the first. With the fringe pattern so sensitive to differences in

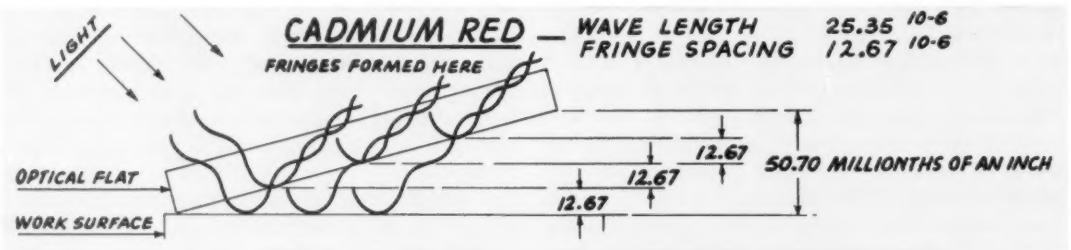
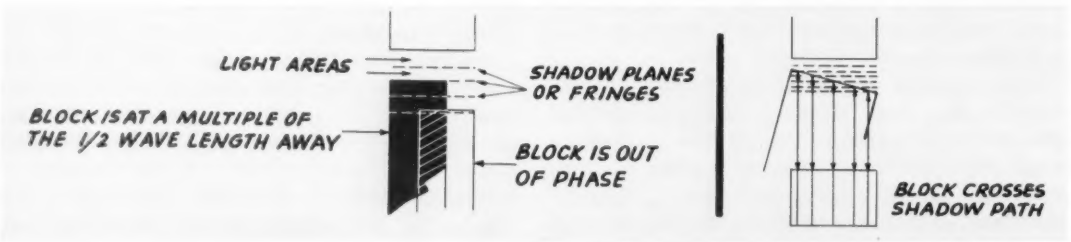


Fig. 3. (Above) Some rays are reflected from the bottom of the optical flat, some from the work surface. Fig. 4. (Below) The block appears black when at a multiple of one-half the wave length.


LIGHT AREAS
SHADOW PLANES OR FRINGES
BLOCK IS AT A MULTIPLE OF THE 1/2 WAVE LENGTH AWAY
BLOCK IS OUT OF PHASE
BLOCK CROSSES SHADOW PATH

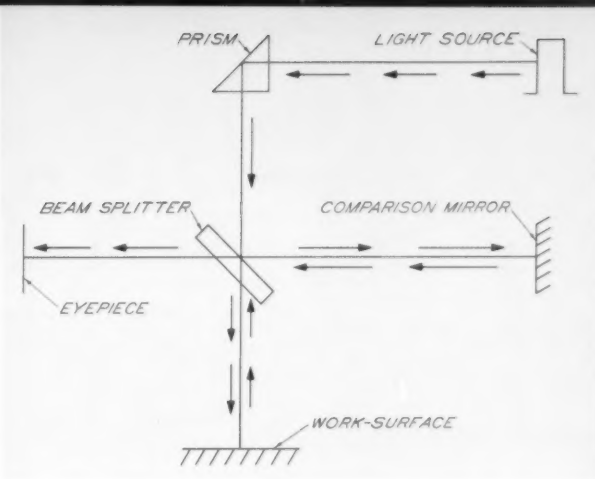


Fig. 5. In the interferometer, the wave lengths are divided into two paths to the eyepiece.

distance between the surfaces, all imperfections cause the over-all pattern to follow the contour of the test surface. If it is minutely smooth and parallel, there is no contour irregularity to be shown. The fringe pattern then is in even, parallel stripes.

But what is this phenomenon and how does the interferometer pick up these light-wave interferences? In Fig. 3 is shown a simple optical flat, and monochromatic light is used—in this case cadmium red. In passing through the glass, some of the light transmits the flat and is reflected back from the work surface beyond, while some rays are reflected from the bottom surface of the glass itself.

The wedge of air between the flat and the work surface reunites the two paths, in some instances, in the exact out-of-phase motion that causes interference fringes. By increasing or decreasing the size of the air wedge, the number of fringes will increase or decrease, but the value of the spacing between them remains the same. It is only by changing the wave length of the light source that the value between fringes can be varied.

In Fig. 4, a different approach is taken. Here, the space between the optical flat and work surface is made up of shadow planes, or fringes, and light areas. If the work-surface is at one-half the wave-length distance, or a multiple thereof, from the bottom of the optical flat, and is parallel to the optical flat, the entire area will be black as it falls within the shadow plane. At any other distance, the entire area will be illuminated.

If the work surface is tilted or out-of-parallel with the flat, the same number of fringes will appear on the surface as the shadow planes it crosses, and the fringes will be positioned at the same location as the crossing occurs. If the work surface is not perfectly flat, the air wedge is varied by this flatness error, and the resulting fringe pattern will depend on wedge variation.

In the case of the simple optical-flat interferometer, the spacing of the fringes depends upon the light source used, and the interference is caused by reflections from the work surface and the bottom of the optical flat. The same principle applies with the more complex interferometer, but the mechanics are somewhat different. (See Fig. 5.) The light, after leaving its source, passes through a movable prism which separates it into its constituent colors, or wave lengths, and selects the one that is to be used. This color beam is then directed to a beam splitter, or half-silvered mirror, which divides the beam and sends it in two directions.

One path, corresponding to the bottom surface of the optical flat in the simple interferometer, takes the reflected light from the beam splitter to a comparison mirror which, in turn, reflects it to the eyepiece. The other path carries a part of the light through a half-silvered mirror and onto the work surface, from which it is reflected to the beam splitter and then to the eyepiece. In the reuniting of these two paths of light, interference is caused and the fringe pattern to be observed on the work surface is produced.

Fringe behavior is also a part of this interference phenomenon, and this is best compared to the appearance of water poured on an uneven surface. The fringe pattern, like water, runs downhill. The patterns in Fig. 6, when considered in terms of the direction of the wedge or line of contact, indicate whether the surface is convex or concave.

It is by this means that the known wave lengths of selected light beams, as constant as their source, can be applied to the critical surfaces of a gage-block, and make possible an infinitesimal tolerance that bears the same relationship to 1 inch that 1 inch bears to 15.8 miles.

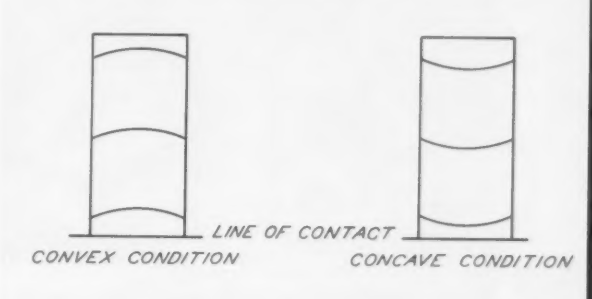


Fig. 6. A convex or concave surface condition is indicated by the curve of the fringe pattern in relation to the line of contact.

PREVIEW

Moore Universal Measuring Machine

A universal measuring machine will be introduced by the Moore Special Tool Co., Bridgeport, Conn. The machine has a work capacity of 11 by 18 by 12 inches, and offers the choice of an electronic indicator supported on a rotatable spindle, or a universal microscope for pick-up. A combination of rectilinear and angular positioning makes possible the measurement of the most complex contours.

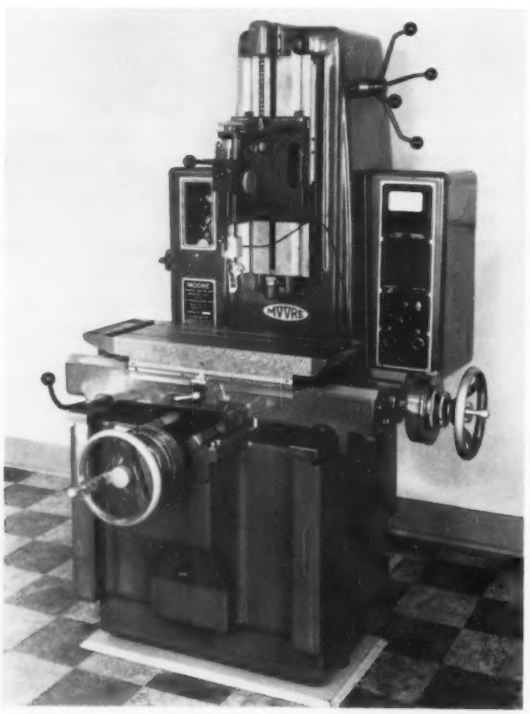
Table positioning in two directions of travel is accomplished with master lead-screws. All ways, prismatic in section, are hardened, ground, and lapped steel, and are fitted to hand-scraped cast iron. Used in combination with the Moore Super-Rotary table, which will also be displayed, angular positioning accuracy is compatible with the coordinate positioning accuracy of the machine table. A Microsine table extends this same accuracy to compound angular settings.

Guaranteed accuracy of longitudinal and cross travel positioning is 0.00001 inch in any 1 inch. Each graduation on the dial has a value of 0.0002 inch, and each graduation on the vernier, 0.00002 inch. Booth 1430.

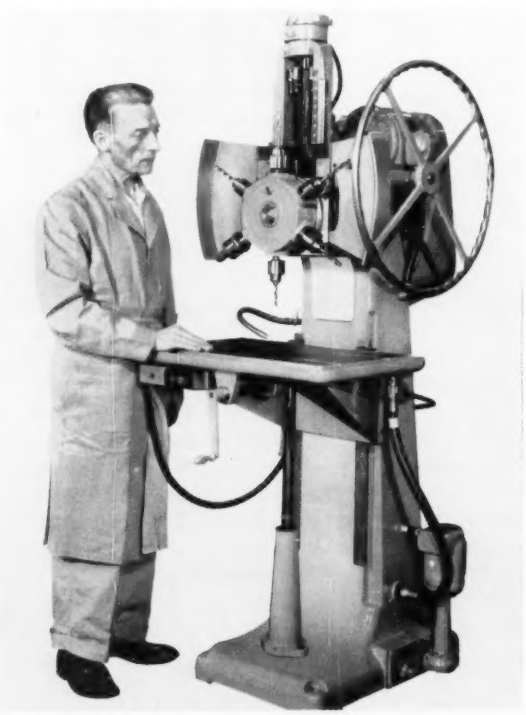
Circle Item 101 on postcard, page 255

Burgmaster High-Speed Turret Drill

A small, fast turret drill known as the Burgmaster Model 1C will be demonstrated by the Burg Tool Mfg. Co., Inc., Gardena, Calif. This machine has a 7-inch stroke and a speed range of 325 to 4050 R.P.M. It will easily produce holes up to 3/8 inch in diameter in steel, and features fast



Moore universal machine for ultra-precise measurement and inspection of complex contours.



Turret drill having a speed range of 325 to 4050 R.P.M., made by Burg Tool Mfg. Co.

OF EQUIPMENT to be Seen at the Show

This Section Includes Only Machines and Tools of New or Improved Design that Have Not Previously Been Described

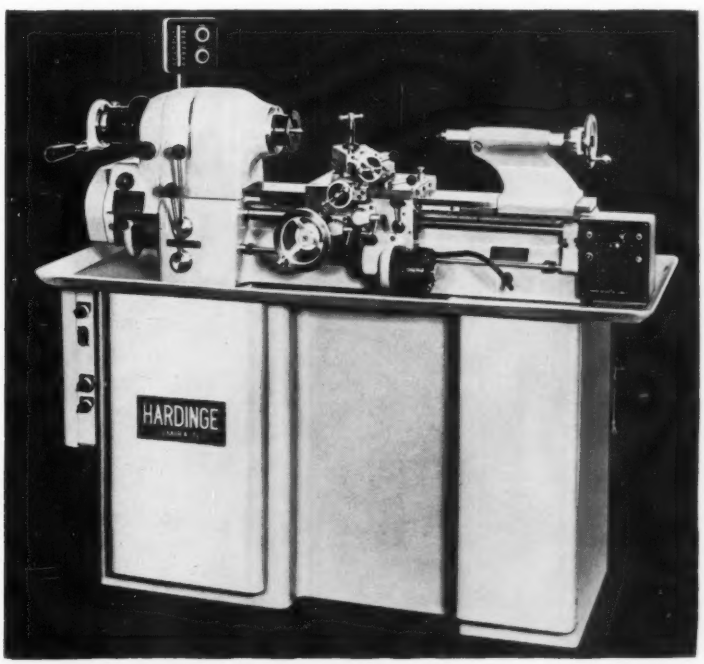
power indexing, sensitive feed, pre-selective speeds and stops. It can perform any combination of six operations that may be required in one set-up.

Other operating exhibits will include an eight-spindle automatic, hydraulic turret drill; a six-spindle automatic, hydraulic turret drill; a six-spindle ram type radial drill; and a six-spindle, hand-operated turret drill. Also, accessories and the "Toolflex" line of floating tool-holders will be displayed. Booth 389.

Circle Item 102 on postcard, page 255

Hardinge Milling, Chucking, and Second-Operation Machines, and Lathes

A complete line of milling, chucking, and second-operation machines, and lathes will be shown by Hardinge Brothers, Inc., Elmira, N. Y. Push-button spindle-speed controls will be featured on all lathes; turning, facing, and boring machines; and second-operation machines. Two buttons on the control box, located over the headstock, give immediate slower or faster speed changes anywhere within the range of the machine.



Hardinge lathe features push-button, infinite spindle-speed control and an independent electric carriage and cross-slide.

Improved models of precision chucking machines will feature independent electrical, variable-speed carriage feed, and automatic three-selector, variable-speed drive. The Model UM universal spiral milling machine will also be shown. Other exhibits will include precision collets and feed fingers, Hardinge-Sjogren speed collet chucks, collet index fingers, and other accessories. Booth 452.

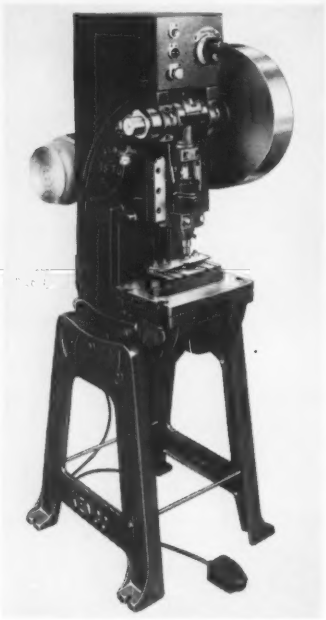
Circle Item 103 on postcard, page 255

Cincinnati Induction and Flamatic Hardening Machines

Process Machinery Division, the Cincinnati Milling Machine Co., Cincinnati, Ohio, will introduce an induction hardening machine operating at 1200 to 1400 kilocycles for rapidly hardening small parts, thin-walled pieces, and other work requiring a shallow case and narrow transition zone. The machine can easily be equipped with automatic work-handling units, and set-up for completely automatic operation. On display will be a fully automated installation for automotive shafts.

For high production, the power supply can be remotely located, and the work and oscillator units placed directly in the production line. The machine is also suitable for low production because the tooling can be easily changed at low cost. Also, the infinitely variable output transformer can easily be adjusted to compensate for error between the design of the coil and the actual geometry of the part. Voltage at the work coil is kept very low for maximum operator safety. Also to be exhibited is a Flamatic hardening machine, operating on city gas and selectively surface hardening automotive sprockets. Booth 100.

Circle Item 104 on postcard, page 255



Many safety devices are featured on this Kenco 15-ton press.

Kenco Electro-Safe Press

A 15-ton Electro-Safe press will be exhibited by Kenco Mfg. Co., Los Angeles, Calif. The operator must depress two widely spaced buttons at the same time to single-trip this machine. In single-stroke operation, press and motor stop after the stroke, thus eliminating double-tripping hazards. The selector switch is locked in single-trip, continuous, or other operating position, preventing the operator from varying the setting. A heavy-duty safety brake is applied at any time the power is disconnected or disrupted. Also, the safety stop-button will stop the press instantaneously, regardless of the point reached in the cycle. The press can single-stroke as many as sixty times a minute. Recommended continuous operating speeds vary within a range of from 20 to 200 strokes per minute. Booth 618.

Circle Item 105 on postcard, page 255

Landmatic Die-Heads and Lanroll Taper Thread Rolling Attachment

A feature of the exhibit by the Landis Machine Co., Waynesboro, Pa., will be Lanroll thread-rolling attachments, Fig. 1, which have been adapted for the precision rolling of taper pipe threads including Dryseal. Either straight or taper threads can now be produced with the same attachment through the use of proper equipment and rolls. Five size attachments provide pipe thread ranges from 1/16 to 1 1/4 inches.

In producing taper threads, the rolls are supported on carbide shafts inclined at the required angle. The roll threads are parallel to the roll axis, and thus have a constant helix. This provides minimum sidewise movement, permitting rolling directly to a shoulder, and reduces slippage between the rolls and the work-piece. The attachment can be tipped to avoid indexing interference.

Redesigned Landmatic hardened and ground die-heads, Fig. 2, will also be on display. These die-heads feature a rapid change, size-adjusting mechanism which provides precision movement and positive locking action. The mechanism consists of a pivoted latch which is held in engagement with notches on the adjusting ring by spring tension. To attach the head, the latch is simply depressed, and the adjusting ring is rotated manually the required amount. A movement of one notch provides a corresponding movement of 0.0005 inch on the pitch diameter of the work-piece.

These stationary, self-opening die-heads are designed primarily for application to turret lathes in which Class 3 and 4 thread tolerances are required. They are available in four sizes: 5/8, 7/8, 1 1/4, and 2 inches. The heads can be used for either right- or left-hand threading with the use of proper chaser holders. The same chasers may be employed for both right- and left-hand work by merely grinding the proper cutting angles at both ends of the chasers. Booth 578.

Circle Item 106 on postcard, page 255

Miller Power Cylinders

The Miller Fluid Power Co., Chicago, Ill., will exhibit power cylinders with chromium-plated piston rods; "Teflon" rod wipers;

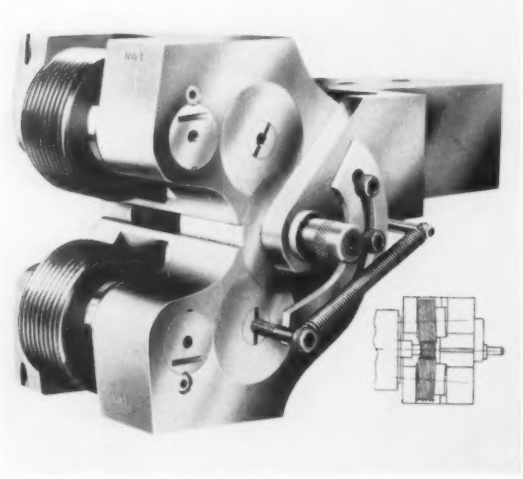


Fig. 1. Lanroll thread-rolling attachment adapted for taper pipe threads.

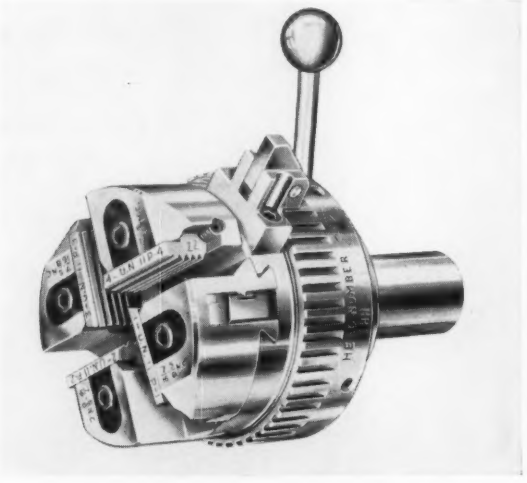


Fig. 2. Rapid change, size-adjusting mechanism is feature of Landmatic die-heads.

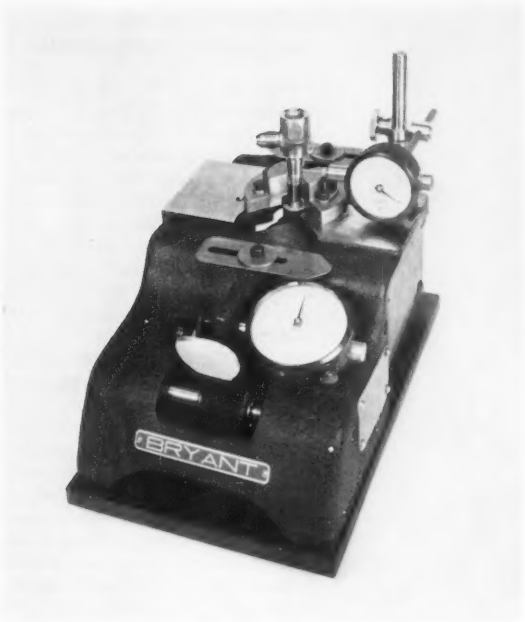


Fig. 1. Bryant bench gage equipped with concentricity attachment.

Fig. 2. Portable gage with segments for O- and snap-ring grooves.

new type threaded seal-fittings; "Teflon" hydraulic rod seals; and rust-resistant black ferric oxide finish on cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods. Recently developed double-acting reciprocating boosters, utilizing the shop air system, that cycle continuously to supply a constant flow of oil for hydraulic cylinder operation will also be displayed. Booth 429.

Circle Item 107 on postcard, page 255

Bryant Gages, Surface Plates, Wheel-Heads, and Spindles

The Bryant Gage and Spindle Division, Bryant Chucking Grinder Co., Springfield, Vt., will display B-21 bench gages for checking internal and external threads. These gages have attachments for checking concentricity, as seen in Fig. 1, and squareness of face in relation to a thread. Also to be exhibited are P-21 portable gages for internal threads, and for 0- and snap-ring grooves, Fig. 2. The portable groove gage is available as a complete kit with segments covering 0- and snap-ring grooves through 5 inches.

"True" granite surface plates and stands, Fig. 3; high-frequency wheel-heads, Fig. 4; high-frequency spindles; belt-driven wheel-heads; boring heads; and magnetic drums for computers will also be shown. Booth 901.

Circle Item 108 on postcard, page 255

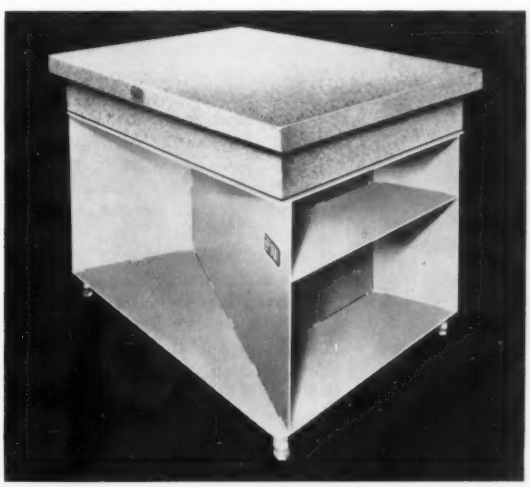


Fig. 3. "True" granite surface plate and stand.

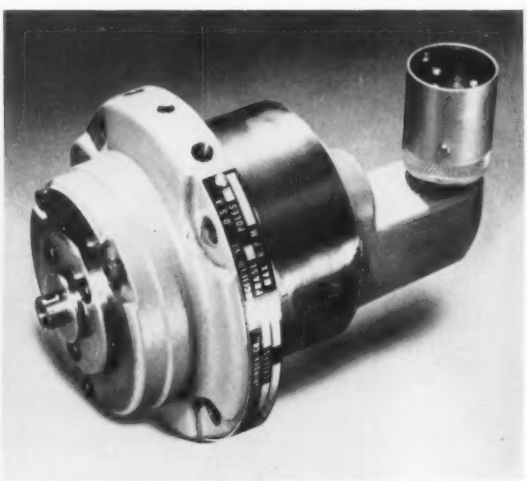
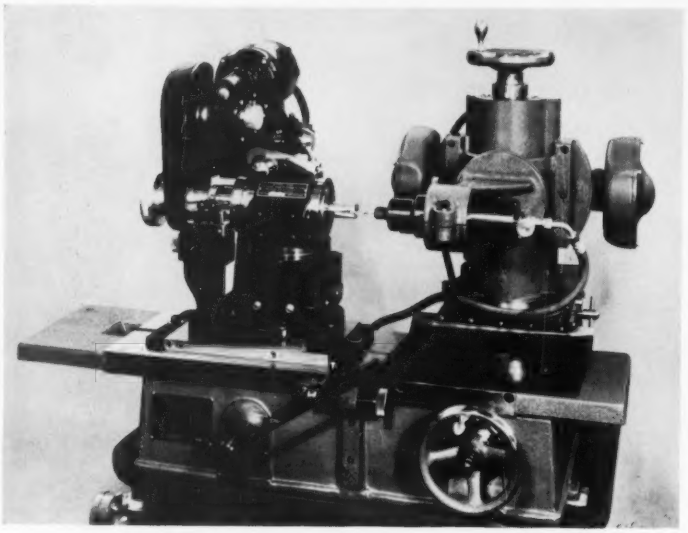


Fig. 4. Series 800 high-frequency wheel-head.



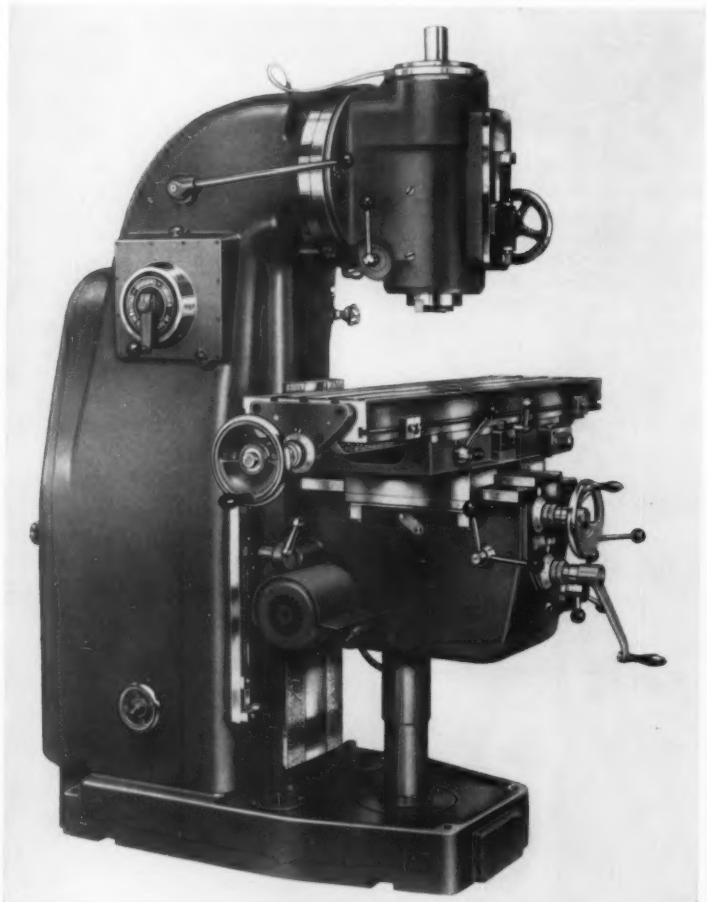
Royal Oak grinder with internal grinding attachment.

Royal Oak Internal Grinding Attachment

The Royal Oak Tool & Machine Co., Royal Oak, Mich., will exhibit an internal grinding attachment for its universal form-relieving fixture designed to form-grind internal cutting edges of hollow mills and trepanning cutters. Angular external surfaces of small cutters that cannot be conveniently ground with large wheels can be form relieved with this device.

The new internal grinding attachment consists of a precision Vulcanaire air spindle having a speed of 65,000 R.P.M. This unit has a Norgren filter and pressure regulator and utilizes regular shop air power. It can be positioned at any angle by means of easily read machined markings and can be raised or lowered by a handwheel. The attachment is mounted on the reverse side of the grinder column so that it is completely out of the way when the grinder is being used on conventional operations. By swinging the column counterclockwise 90 degrees, the internal grinding wheel can be brought into operation at the side of the work. By swinging the column 180 degrees clockwise, it can be brought into position for end grinding. Booth 278.

Circle Item 109 on postcard, page 255



SAJO No. 2 vertical milling machine having twelve spindle speeds from 39 to 1500 R.P.M.

SAJO Milling Machines and VMA Shapers

Austin Industrial Corporation, White Plains, N. Y., will display a group of SAJO No. 2 vertical, universal, and plain milling machines; and a line of VMA shapers. The vertical milling machine has a working surface of 47 1/4 by 11 inches, and a longitudinal power feed of 33 1/2 inches. Twelve spindle speeds, ranging from 39 to 1500 R.P.M., can be selected by a direct reading dial and single crank. The spindle is mounted in anti-friction bearings and has an American Standard No. 50 milling machine taper. The spindle head can be swiveled 45 degrees to the left or right from the vertical.

The VMA 26-inch stroke heavy-duty shaper, with ten power feeds ranging from 0.008 to 0.080 inch per stroke, and eight ram speeds varying from 10 to 110 strokes per minute will also be displayed.

Power rapid traverse to the table of this machine is driven by an independent 1-H.P. motor with automatic safety device. Automatic forced lubrication is provided by a pump supplying oil under a pressure of 400 pounds per square inch to each lubrication point. Each pipeline is fed by an individual piston, and the oil supply is adjustable. Booth 550.

Circle Item 110 on postcard, page 255

Pullmax Trimmer for Edge-Trimming Large Stampings

The American Pullmax Co., Inc., Chicago, Ill., has added a completely new trimmer to its growing line of machines. Outstanding features claimed for this machine are versatility and rugged construction.

The pneumatically operated head can be raised 2 inches, thus making it possible to insert bulky material quickly and easily. The remote foot-pedal control makes it possible to raise and lower the head, and to engage and disengage the cutting tools while keeping both hands free for handling the work-piece.

The machine is supplied with guide bars that can be detached when edge-trimming a large stamping, center-cutting a deep-drawn stamping, and performing many other operations. The guide bars can be left on when a large piece of metal has to be shaped. Booth 689.

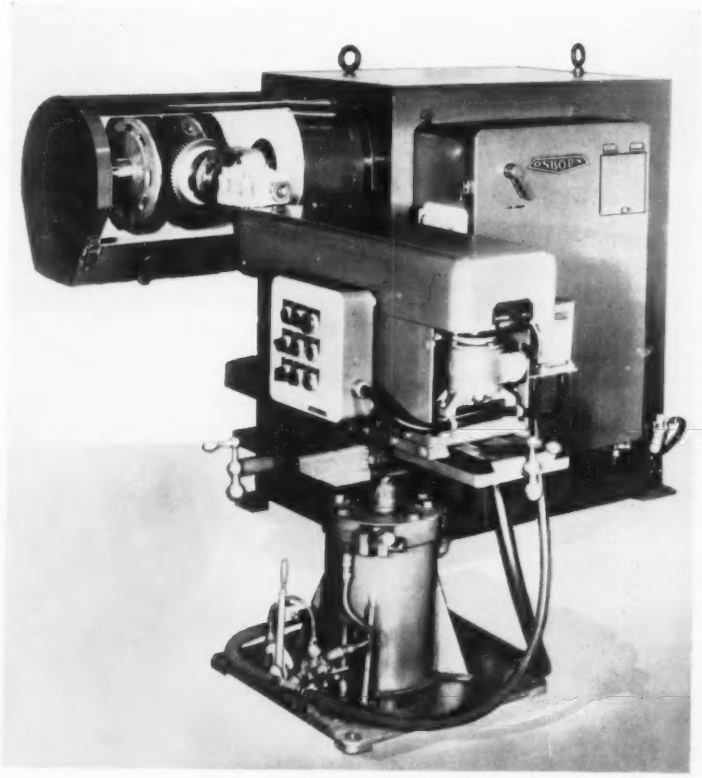
Circle Item 111 on postcard, page 255

Edge-trimming stampings on new American Pullmax machine.

Osborn Power Brushing Machines

Recent developments in power brushing and the Brushamatic 3A machine will be demonstrated by the Osborn Mfg. Co., Cleveland, Ohio. Also, information and production data will be available on the Brushamatic 301 series of completely automated equipment for high-speed production-line work. On the 3A semi-automatic brushing unit, the operator has only to place the work-piece on the fixture, and remove brushed parts. Feeding and retraction of the work-holder, as well as rotation of the brushes, are automatically controlled on a pre-set time cycle. Booth 466.

Circle Item 112 on postcard, page 255

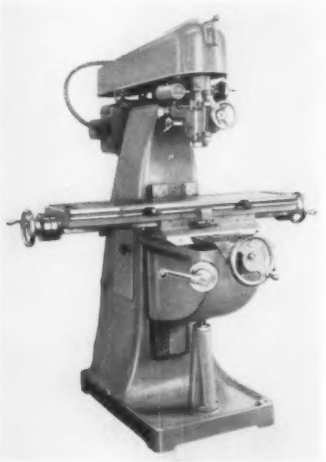


Brushamatic semi-automatic brushing machine to be displayed by the Osborn Mfg. Co.

U. S. Burke to Display New Milling Machines

Two completely new milling machines will highlight the display of the U. S. Burke Machine Tool Division, Cincinnati, Ohio. Featured in the display will be the radically new "Quartet" No. 2, horizontal, universal, knee type milling machine which may be used for horizontal, universal, vertical, or angular milling.

This machine is powered by a 3- or 5-H.P. motor with an infinitely variable speed drive to the horizontal spindle. The unit is equipped with a heavy-duty turret, which can be swiveled to adapt the machine to universal milling operations. At the rear of the rectangular type over-arm is mounted an independently driven vertical milling head with power feed to the quill. For vertical and angular milling, the head is indexed into position over the table.



Burke vertical "Powerfeed" head milling machine

The second completely new machine to be exhibited is the vertical "Powerfeed" head milling machine illustrated. This mill has large knee, saddle, and table members; giant-sized micrometer dials; and is equipped with a 1-H.P., reversible motor which drives the vertical head. The feed rate of the head is infinitely variable from 0.002 to 0.008 inch per revolution. The machine features a completely enclosed hard chromium-plated quill with a 5 1/2-inch power travel and an 800-pound "down thrust." Booth 604.

Circle Item 113 on postcard, page 255

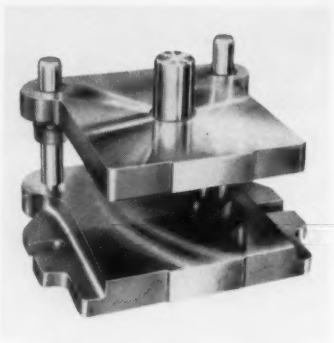


Fig. 1. Die set of "Leadership Line" to be displayed by Danly Machine Specialties, Inc.

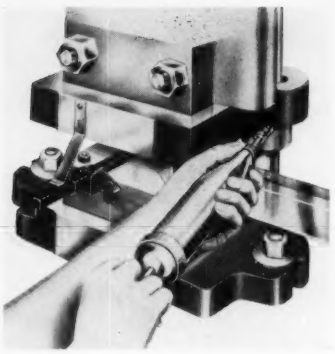


Fig. 2. Danly guide posts and bushing equipped to facilitate use of lubricating gun.

Danly Announces "Leadership Line" of Die Sets and Diemakers' Supplies

Danly Machine Specialties, Inc., Chicago, Ill., will introduce a complete new "Leadership Line" of die sets and diemakers' supplies. The new die sets have been developed to offer several major advantages to diemakers. Precision-lapped chromium-plated guide posts are standard equipment in all precision die sets in the new line. These "Microme" guide posts are chromium-plated to provide exceptionally high resistance to wear. Steel shoulder bushings prolong die-set life, and demountable bushings are available as an optional feature. Oil fittings are positioned so that they are easily reached from the front or side of the press, and will not interfere with die regrinding or other adjustments.

Figure-8 oil-grooves distribute a dependable oil film between the guide posts and bushing surfaces. There is a complete new line of long- and short-shoulder precision bushings of hardened steel, plus shoulder bushings of special-alloy hard bronze. A simple clamping method is provided for die sets which have a right-to-left die area dimension (ASA specifications) of 20 inches or more. This method is said to be faster and easier than methods previously employed.

Removal of punch holder during die making, die setting, and regrinding has been facilitated by making one guide post 1/2 inch longer than the other (on all standard sets except the "floating adapter"). Danly precision die sets now meet or exceed all ASA standards specifications. For every size of standard die listed by the American Standards Association, there is a Danly die of comparable size with die space and guide post dimensions which equal or exceed ASA specifications.

Danly precision die sets are

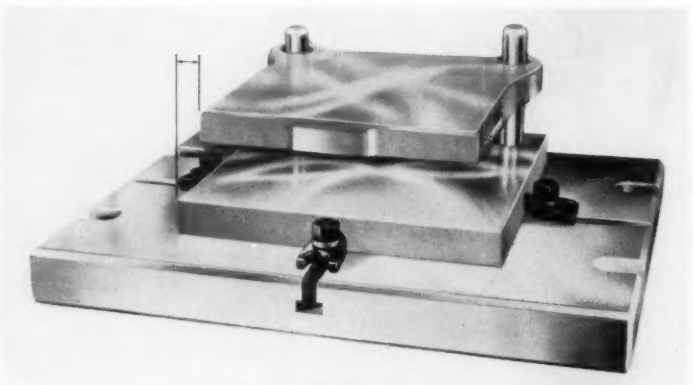


Fig. 3. Die set mounted on bolster plate to show new clamping method.

available in a broad range of sizes. All four horizontal surfaces—including the top of the punch-holder—are ground to a high finish to attain the highest possible degree of accuracy in positioning the die sets. The top surface of the punch-holder is vented. Booth 596.

Circle Item 114 on postcard, page 255

Cogsdill Deburring and "Bearing-izing" Tools

"BurrAway" and "BurraMatic" hole-deburring tools and a "Bearing-izer" for producing work-hardened surfaces will be demonstrated by Cogsdill Tool Products, Inc., Detroit, Mich. The "BurrAway" tool, stocked in sizes from 1/8 to 1 inch in diameter, consists of a high-tensile, stress-resisting steel rod, rifle-bored and tapped from one end and slotted near the other to receive a high-speed steel cutter blade hinged on a pin which passes through the slot.

A manually operated vertical drill press will be used to demonstrate the "BurraMatic" hole-deburring tool which operates on the same basic principle as the "BurrAway," except that provision is made to control the cutting tool in such a way as to produce more accurate chamfers.

The "Bearing-izer" automatically produces a work-hardened low micro-inch surface on either the inner or outer surfaces of cylindrical parts, circular flats, and various other parts. This tool, which operates at a surface speed of 300 to 500 feet per minute, has hard steel cam-actuated peening rolls which provide as many as 200,000 blows a minute to furnish a hardened, burnished surface of accurate dimensions. Booth 185.

Circle Item 115 on postcard, page 255

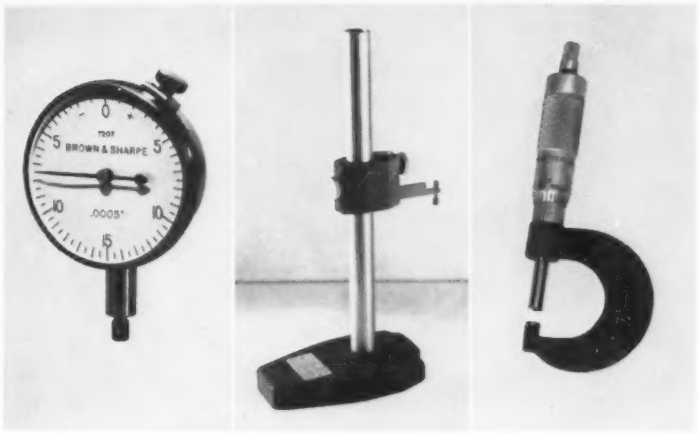


Fig. 1. Precision measuring instruments to be exhibited by the Brown & Sharpe Mfg. Co.

Brown & Sharpe Adds New Products to Its Line of Precision Shop and Tool-Room Equipment

A number of industrial products will be added to the established line of precision tools, milling cutters and arbors, electronic measuring equipment, screw machine tools, permanent magnetic chucks and pumps to be exhibited by the Brown & Sharpe Mfg. Co., Providence, R. I. The view at the left, Fig. 1, shows one of an expanded line of forty-seven styles and sizes of dial gages with plain and jeweled bearings, including shockless types.

The Hite-Chek (center view, Fig. 1) has a rugged, precise holding post that facilitates fine adjustment for the accurate transfer of precision settings. Both ball and post are provided with attachments for holding dial indicators. This tool can be used for surface plate work as well as for set-up work on machines. The 1-inch micrometer (view at right, Fig. 1) has a black frame and dull chromium finish for easy reading. It has 0.0001 as well as 0.001 inch graduations.

The small bench centers, Fig. 2, are for use where work does not exceed a length of 18 inches. Permanent magnet chucks like the one shown in Fig. 3 will be exhibited in two rectangular models 5 by 10 inches and 6 by 8 inches. These light, low chucks have large magnetic surfaces and increased holding power.

The drop-forged rolling mill caliper gage (lower view, Fig. 4) is designed to withstand severe use in measuring sheet iron and steel in rolling mills.

Other products to be displayed include a Tri-Cal universal vernier caliper shown in the upper view, Fig. 4. This tool takes outside, inside or depth measurements directly to a 0.001 inch. The double-

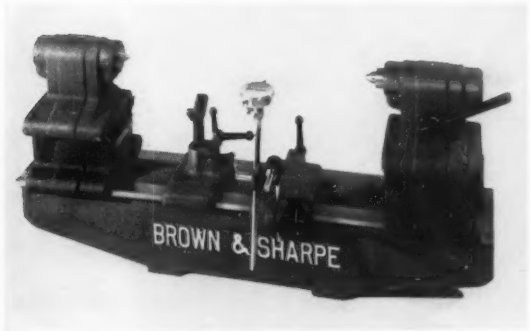


Fig. 2. Brown & Sharpe bench centers.

Fig. 3. Brown & Sharpe permanent magnet chuck.

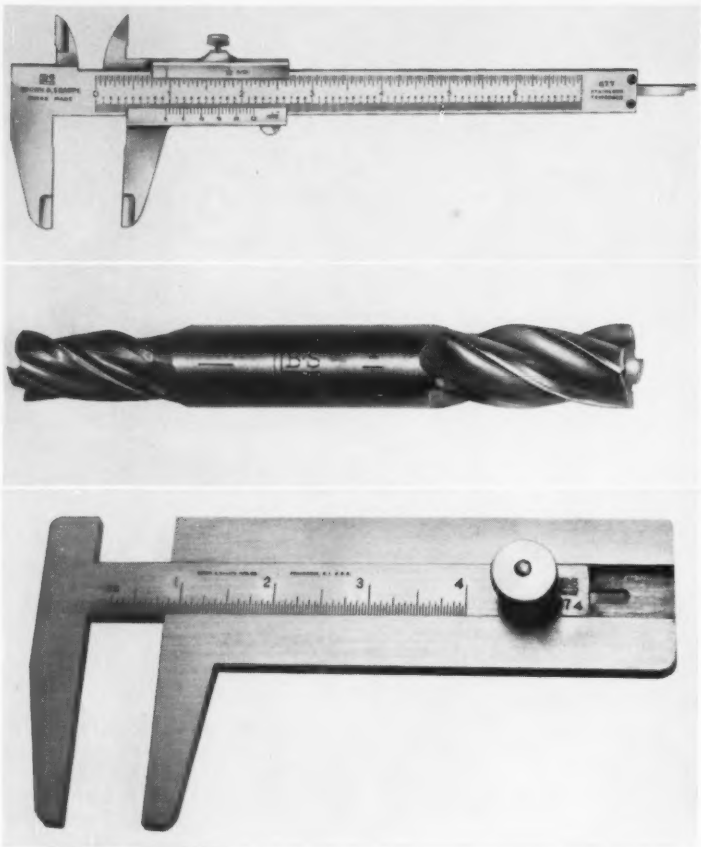


Fig. 4. (Top) B & S Tri-Cal universal vernier caliper. (Center) Double-end end-mill. (Bottom) Caliper gage for use in rolling mill.

end end-mill (center view, Fig. 4) is a new, fast cutting design having different diameters at each end of the shank. This tool is made in two-lipped and four-lipped designs. Booth 374.

Circle Item 116 on postcard, page 255

Wales-Strippit to Exhibit "Positive Duplicator"

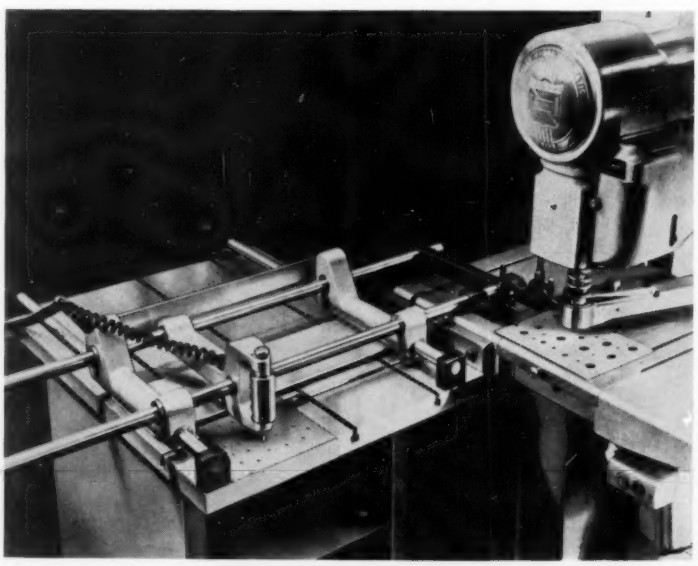
The Wales-Strippit Corporation, North Tonawanda, N. Y., will exhibit a new device for its "Fabricator" sheet metal punching machine. This new equipment called the Wales "Positive Duplicator" is an ingenious pantograph-like mechanical device for locating holes in simple or complicated patterns, and actuating the punching mechanism of the Fabricator from a template, by remote control, yet with extreme accuracy.

Rolling on special ball bearings, the locator carriage assembly of the duplicator is smoothly and effortlessly moved in any direction, and at the same time the work-piece, securely held by the clamps, is automatically moved into position under the punching mechanism of the Fabricator. As each hole is located the operator simply presses the locator pin into the template aperture. This automatically closes a micro switch in the locator assembly and actuates an air cylinder in the rear of the Fabricator, which in turn operates the punch-tripping mechanism.

A tube-piercing unit, with a capacity for handling tubes from 1/2 to 1 inch in diameter will also be displayed. This unit is designed for use in either a press brake or punch press. The maximum punch diameter is 0.312 inch and the maximum wall thickness of tubing which can be pierced is 0.093 inch.

Other equipment to be exhibited includes a Wales Model 10-AA sheet metal Fabricator and self-contained punching and notching units. Booth 379.

Circle Item 117 on postcard, page 255

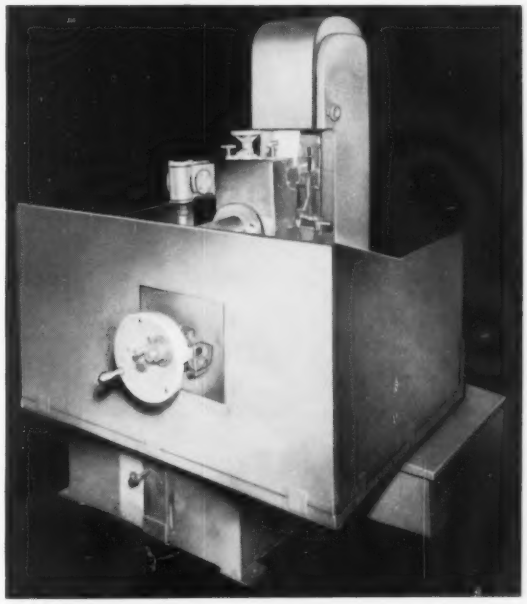


Wales-Strippit "Fabricator" sheet-metal punching machine equipped with "Positive Duplicator"

Wadell Automatic Vertical Boring Machine

A "VBM" automatic vertical boring machine, designed primarily for precision boring, counterboring, facing, and chamfering operations, will be demonstrated by the Wadell Equipment Co.,

Automatic vertical boring machine to be introduced by the Wadell Equipment Co.

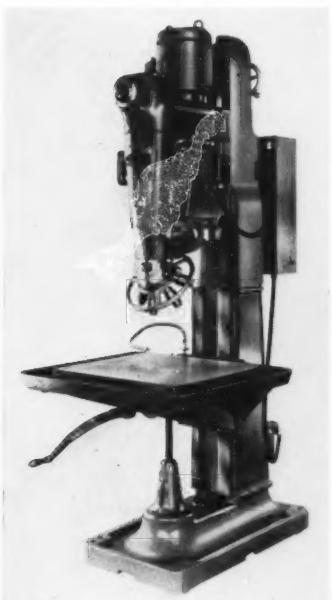


Centerless grinding and finishing machine exhibited by Production Machine Co.

Garwood, N. J. This machine is built to maintain tolerances as close as 0.0001 inch and surface finishes of 10 micro-inches r.m.s. when properly tooled. The machine is of compact, rigid design; occupies only 4 square feet of floor space; and is intended for use in the rapid production of small- and medium-size parts.

Featuring an intermittent or continuous automatic cycle, the machine can be incorporated in an automation system, either as a single unit or in multiple units. It may also be used in a production line with other automatic machines. The standard cycle time is five to eighty seconds, but the machine can be equipped for a faster or slower cycle. It is also available with or without tooling. Other features are simplicity of set-up and operation. The maximum stroke is 4 inches, and the maximum spindle speed is 8000 R.P.M. Booth 135.

Circle Item 118 on postcard, page 255



Turret drilling and tapping machine displayed by Howe & Fant

Howe & Fant Turret Drilling and Tapping Machine

Howe & Fant, Inc., East Norwalk, Conn., will display a turret drilling and tapping machine with a universal jig base. The base makes possible rapid and accurate positioning of work under the turret spindles. Up to six different operations, in any desired sequence, can be completed with only one handling of the work. Individual spindle speeds and feed depths, as well as reversals for tapping, are pre-set and repeat automatically as the turret is indexed. Booth 575.

Circle Item 119 on postcard, page 255

Centerless Grinding Machine Introduced by Production Machine Co.

The Production Machine Co., Greenfield, Mass., will exhibit three machines, using coated abrasive belts. The Type 486 centerless grinding and finishing machine illustrated will be shown for the first time. It will be in operation, grinding bar stock to very close tolerances. This machine will handle bar stock up to 1 inch in diameter and tubing up to 3 inches in diameter, any length, within the weight limitations of the machine.

Abrasive belts, running over a hardened steel contact roll, serve as the cutting medium. The feeding unit is also an abrasive belt with flat platen which permits center line contact with workpiece at any feeding angle. These features eliminate the need for periodic dressing of grinding or regulating wheels.

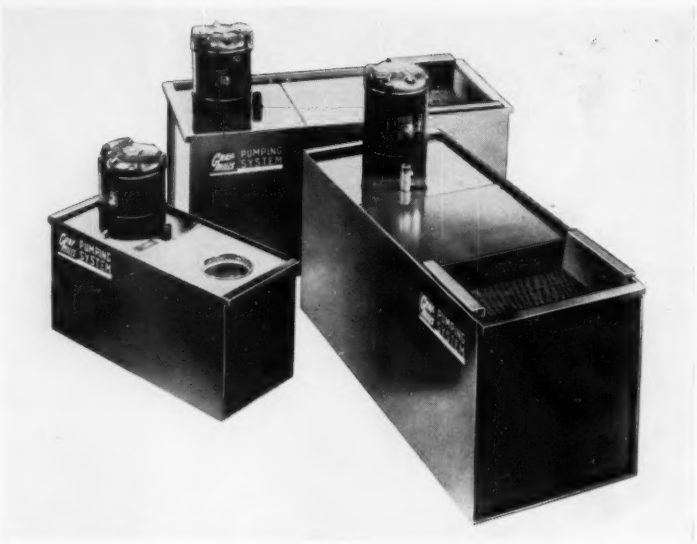
The feed unit may also be equipped with reversing traverse device when multiple passes are required. This unit is adjustable by feed-screw and handwheel, with infeed graduations in increments of 0.0002 inch for precision size control. The grinding belt is 4 by 86 inches and operates at a surface speed of 3500 feet per minute. The feed-belt is 6 by 29 3/4 inches and its speed is vari-

able. A 3-H.P. motor is employed for the main drive, and a 1/4-H.P. motor for the variable-feed drive. A 1/4-H.P. motor serves the coolant recirculating system. This machine requires a floor space 60 by 50 inches.

A Type 484 duplex machine, also equipped with abrasive belts will be demonstrated, performing a two-pass polishing operation with a single handling at high rates of production.

Deburring, surfacing, grinding and finishing operations on parts where opposite sides are to be treated simultaneously will be demonstrated on a twin-belt surfacing machine. Booth 625.

Circle Item 120 on postcard, page 255



"Superflo" coolant pumping units added to Graymills line

Clausing Multiple-Spindle Drill Press

An 18-inch, heavy-duty, multiple-spindle drill press will be demonstrated by the Clausing Division, Atlas Press Co., Kalamazoo, Mich. This drill press has a heavy table with an 84 by 22 inch working surface. Holes 1 inch in diameter can be drilled in cast iron, and 3/4 inch in diameter in steel. The machine has ball-bearing equipped, No. 3 Morse taper spindles, with 6 1/2-inch spindle travel. Hand feed or gear-driven power feed are available, and a built-in switch is provided.

Other Clausing machine tools to be exhibited include the 6300 and 5300 series, 12-inch lathes, and a vertical milling machine. Booth 1418.

Circle Item 121 on postcard, page 255

Clausing 18-inch multiple-spindle drill press.

New "Superflo" Coolant Pumping Units Added to Graymills Line

The Graymills Corporation, Chicago, Ill., will display its complete line of new "Superflo" coolant pumps and pumping units. There are thirty-six standard models in this line, all built to J.I.C. standards. The three "Superflo" coolant pumping units shown in the accompanying illustration are recent additions to the line. One of these units has a 1/4-H.P. centrifugal pump with a 10-gallon baffle-equipped tank. The two other units have 38-gallon tanks, one with a 1/2-H.P. pump and the other with a 3/4-H.P. pump.

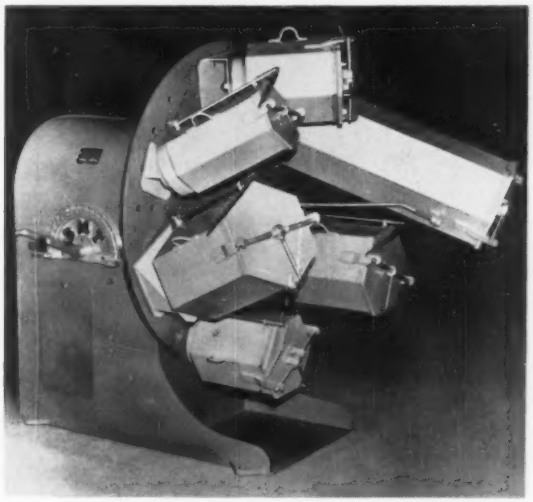
The "Superflo" centrifugal pumps deliver a high volume of coolant for peak requirements, but may be throttled to a trickle, providing a wide range of coolant flow. All pumps are abrasive-proof and can be used on grinders, milling machines, etc. Motors are totally enclosed, standard NEMA face- or foot-mounted to comply with J.I.C. standards, and have drip-proof, lifetime lubricated ball bearings. Booth 360.

Circle Item 122 on postcard, page 255

Horton Controlled Centering-Pressure Chuck

Horton Chuck, Division of the E. Horton & Son Co., Windsor Locks, Conn., will feature a centering device in their line of J-Type chucks for use in machining

Horton controlled centering-pressure chuck.



BMT multi-barrel precision SlideHoning machine.

jet-engine parts. This controlled centering-pressure chuck permits the centering of thin-walled rings and parts at a pre-set pressure without distortion. The three universal jaws are moved toward the work-piece, and they stop automatically when the piece is centered and all three jaws make contact. Then, the twelve independent jaws are moved in to pinch the part in its centered position. All jaw ways are sealed from chips regardless of the jaw positions.

Also to be displayed are the Tru-Set chuck line having a guaranteed accuracy of 0.0002 inch total indicator reading; and the Windsor line of independent and universal chucks. Booth 764.

Circle Item 123 on postcard, page 255

BMT Barrel Finishing Equipment

A multi-barrel SlideHoning machine will be displayed by the BMT Mfg. Corporation, Elmira, N. Y. This precision tumbling unit performs controlled-motion honing for removing burrs, flash, tool marks, plate, scale, or paint, without affecting dimensional tolerances of the work-pieces. Up to twenty-five barrels can be mounted on the unit. Also on exhibit will be barrel finishing compounds, media, and abrasives, as well as metal and plastic parts currently being finished by this process. Booth 709.

Circle Item 124 on postcard, page 255

Rahn surface plate calibrating device

Rahn Surface Plate Calibrating Device

A new device for calibrating surface plates will be shown by the Rahn Granite Surface Plate Co., Dayton, Ohio. The manufacturer claims that it is possible to accurately calibrate a surface plate 24 by 36 inches, with optical instrument precision, in forty-five minutes with this device. No calculations are required.

The entire calibration consists of merely taking indicator readings under a straightedge, adjustably mounted, so that it can always be supported in the exact reference plane. The precision of the calibration is limited only by the precision of the indicator being used. A precision of 10 millionths of an inch can be attained with electronic indicators. A method of proving accuracy of the straightedge is also supplied. Booth 928.

Circle Item 125 on postcard, page 255

Fig. 1. Motorized spindle units to be displayed by the Standard Electrical Tool Co.

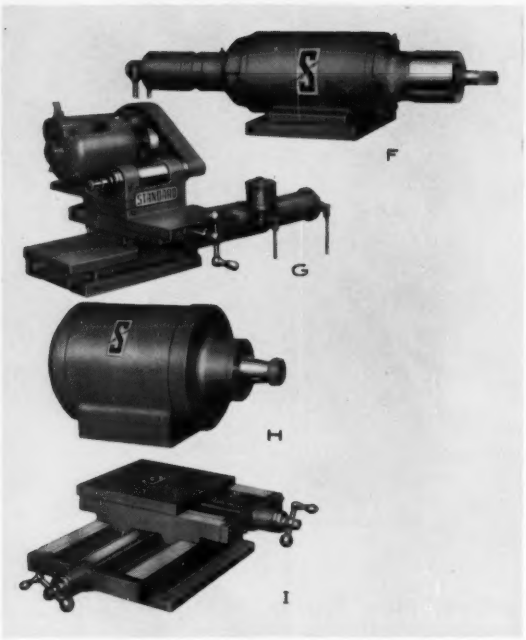


Fig. 2. Precision spindle units and compound slide introduced by the Standard Electrical Tool Co.

Standard Electrical Tool Exhibits Precision Spindle, Slide and Feed Units

The Standard Electrical Tool Co., Cincinnati, Ohio, will exhibit super-precision spindles in a wide range of sizes and types. Units with spindles of exceptional accuracy adaptable for a wide range of grinding, boring, milling, drilling and routing operations will be displayed. Typical examples of the many units to be exhibited which offer means of improving tolerances on production work, improving existing production equipment with new accessories and converting old machine tools into high-production equipment are shown in the three accompanying illustrations.

At *A*, Fig. 1, is shown a motorized spindle ram conversion unit for a King 72-inch boring mill. This unit has a 5-H.P. motor at the upper end which runs at a speed of 1800 R.P.M. A 1-, 7 1/2-, 10-, or 15-H.P. motor can be furnished in place of the 5-H.P. size. The motor can have either a speed of 1800 or 3600 R.P.M. or it can be of the dual-speed type. With this unit the ram is extended 12 inches making a total ram length of 94 inches.

An internal spindle (available in various lengths and diameters) is shown at *B*. At *C* is shown an external grinding spindle. This Series 6000 dynamically balanced, permanently lubricated motorized spindle has an integral adapter for boring mill ram or turret applications. The swivel base spindle illustrated at *E* has a No. 1E feed. This base can be swiveled about a complete circle or 360 degrees.

At *F*, Fig. 2, is shown a type RG work-head with air cylinder and special automatic chucking spindle nose designed to handle a specific work-piece. The assembly seen at *G* consists of a 1/2 BPA grinder having a dynamically balanced, permanently lubricated spindle, a compound slide, metal way covers, micrometer dial on the cross-feed unit and an air-draulic cylinder for actuating the longitudinal traverse slide.

A 15-H.P. motorized spindle without a mounting pad is illustrated at *H*. This spindle has a speed of 1200 R.P.M. A No. 2E compound slide with taper gibs and micrometer dials is illustrated at *I*. A group of super-precision spindles for grinding, boring, drilling, milling, and routing work-heads is illustrated in Fig. 3.

Fig. 3. Super-precision units for grinding, boring, drilling, milling, and routing work-heads.

Circle Item 126 on postcard, page 255

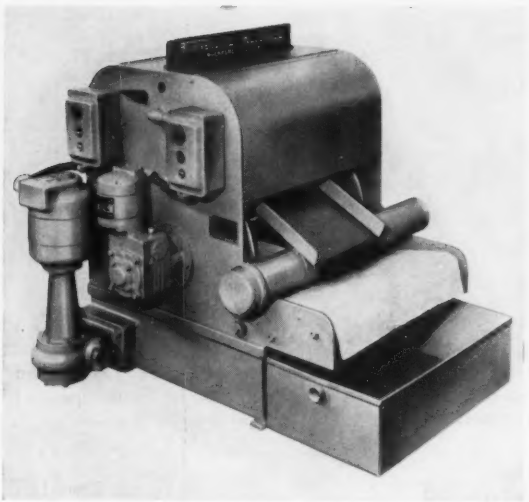


Fig. 1. New Kleenall combination magnetic and fabric type filter to be displayed by Barnes Drill Co.

Fig. 2. BarnesdriL magnetic coolant separator with sludge pan and rubber roller.

"BarnesdriL" Coolant Filters, Separators, and Honing Tools

The Barnes Drill Co., Rockford, Ill., will exhibit a representative model of the BarnesdriL line of combination magnetic and fabric filters. This model, designated Kleenall, illustrated in Fig 1, will be shown in an operating display filtering and cleaning a continuous stream of contaminated coolant. Visitors will be able to observe the two-stage cleaning action of this filter. The magnetic drum attracts and removes the major contaminant and the fabric filtering media remove the remaining foreign material. This two-stage process is said to provide a coolant having an unusually high degree of clarity.

A representative model of the BarnesdriL line of magnetic coolant separators will also be displayed. This unit, Fig. 2, will be incorporated in a display simulating actual operating conditions. A contaminated coolant will be delivered continuously to the separator. The action of the unit as it separates ferrous particles and entrained material from the coolant mixture, and the high degree of coolant clarity attained will be demonstrated. Visitors will also be able to see how easy it is to dispose of the swarf and sludge by simply emptying the sludge pan, which requires attention only at long intervals of time.

Other products to be exhibited include BarnesdriL high-production honing tools and abrasives. The particular features of the H-S

Fig. 3. High-production BarnesdriL honing tool used for small to medium-sized bores, employing "Plas-T-Clad" full-depth stones.

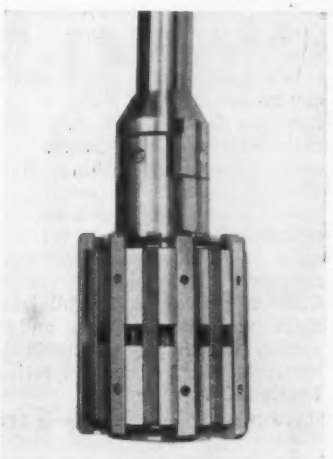


Fig. 4. BarnesdriL production honing tool for medium and large size bores using "Plas-T-Clad" skirt-mounted stones.

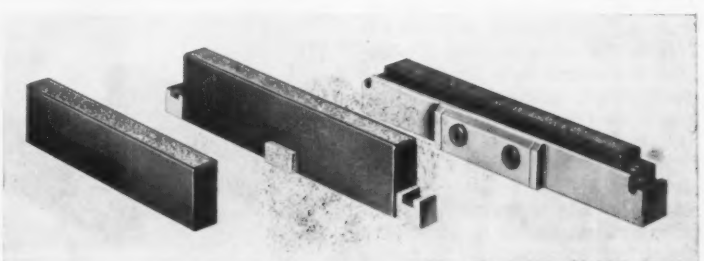


Fig. 5. Types of stone mountings used with BarnesdriL honing tools.

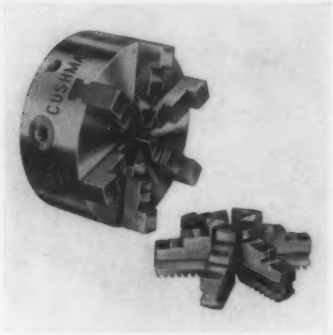


Fig. 1. Cushman Accra-Set chuck permits repetitive accuracy to 0.0005 inch or less.

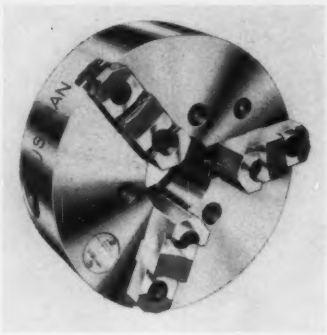


Fig. 2. Three-jaw, scroll-operated compensating chuck permits gripping irregular parts.

Fig. 3. Compensating action can be locked-out on this air-operated compensating chuck.

(slotted body) honing tools, Fig. 3, are the direct body support of the stone near the cutting face and the full support of the stone area that is subjected to the expansion pressure.

The BarnesdriL "Plas-T-Clad" abrasive stones, Fig. 5, are supported on the sides by the tool body. The use of nearly the full depth of the honing stone is possible with this design, where the side support is stationary and the expansion support moves as the hone is expended. Protective material covers the sides of the stone to prevent spalling. With this tool design the set of expended stones can be removed and new stones inserted in a few seconds. Various types of drive adapters, stone holders, "Plas-T-Clad" abrasives of the full-depth skirt and clamp types, and a variety of sample parts will be available for close inspection. Booth 1127.

Circle Item 127 on postcard, page 255

Barker Milling Machines

Three models of milling machines will be demonstrated by Barker Engineering Co., Cleveland, Ohio. The model A.M. heavy-duty milling machine seen at the left in the accompanying illustration is powered by a 3/4-H.P. motor, and is furnished complete with pedestal. The Dual-Mill shown at the right is equipped with two 1/3-H.P. motors. A variable speed drive makes it possible to run either spindle at different speeds. Also to be displayed is a standard bench milling machine featuring three-way travel. Booth 731.

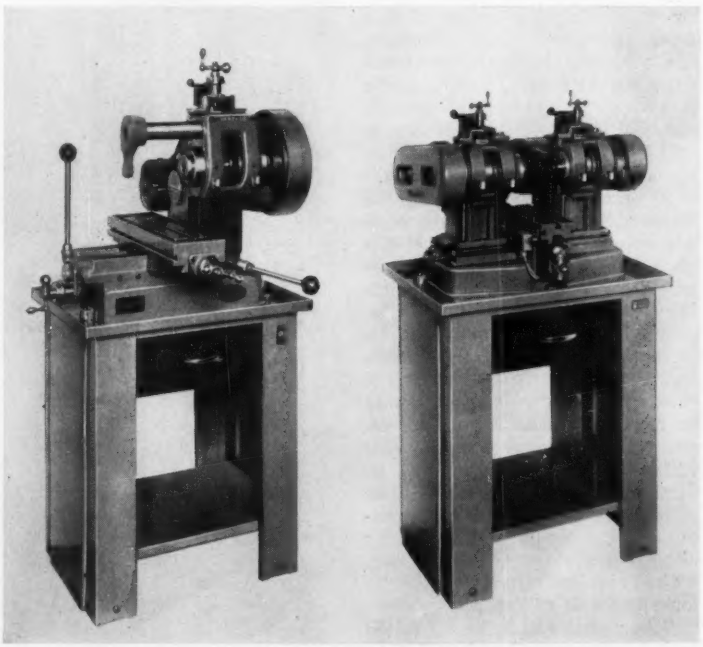
Circle Item 128 on postcard, page 255

New Chucks Added to Cushman Line

The Cushman Chuck Co., Hartford, Conn., will introduce several new chucks. One, called the Accra-Set chuck and seen in Fig. 1, has been designed for close limits. Simple, quick adjustment is possible with repetitive accuracy of 0.0005 inch or less, total indicator reading. The adjusting mechanism consists of four screws, equally spaced around the periphery and placed on a compound angle, which contact hardened steel balls. Accra-Set chucks are available with three or six jaws in 6-, 8-, and 10-inch sizes.

A three-jaw, scroll-operated compensating chuck, Fig. 2, has been added to the Cushman manually operated chuck line. This design provides appreciable compensation and permits gripping irregular work-pieces which have been previously centered. Jaw compensation is achieved by a two-piece scroll. Clearance in the body permits the upper jaw to float.

The air-operated compensating chuck shown in Fig. 3 offers a high degree of compensating ac-



(Left) Barker heavy-duty milling machine, and (Right) Dual-Mill having two motors and variable-speed drive.

tion, and can be used as an ordinary self-centering, air-operated chuck after truing on a spindle and locking-out the compensating action. Compensation is accomplished by a lever cage that is free to float, and into which the jaw operating levers are pinned. Locking-out is achieved by three adjusting screws. Booth 579.

Circle Item 129 on postcard, page 255

Ferguson Index Table and Transfer Assembly Machine

The Ferguson Machine & Tool Co., St. Louis, Mo., will show an "Intermittor" high-speed, precision index table capable of producing 30,000 pieces per hour. More than 150 standard models are available in the line, with dial sizes ranging from 12 to 60 inches, and the number of stations varying from 4 to 36.

A "Trans-O-Mator" straight-line transfer machine for automatic assembly will also be demonstrated. This machine is 14 feet long and has 60 stations. Another product to be exhibited is the Ferguson drive, a cam indexing mechanism for production machinery employing intermittent motion. Booth 350.

Circle Item 130 on postcard, page 255

Ingersoll-Rand Impactool has torsion bar type torque control for nut running.

Ingersoll-Rand Impactools and Automatic Connecting-Rod Assembly Machine

Impactools featuring the application of the torsion bar principle for torque control on nut running will be demonstrated by Ingersoll-Rand, New York City. These tools have multiple torque settings that are easily changed with the aid of an adjusting collar and torque jig. When the pre-set torque is reached, the tool shuts off automatically. Two sizes will be shown, one for torques up to 90 foot-pounds, and the other for torques up to 550 foot-pounds.

Also, a completely automatic multiple nut runner that assembles connecting-rods will be displayed. This machine presses in the bolts, feeds the nuts, and runs the nuts to a prescribed torque. Other exhibits will include a line of angle drills and push-button reversible screwdrivers. Booth 345.

Circle Item 131 on postcard, page 255

Ferguson "Intermittor" high-speed, precision index table.

Motch & Merryweather Cutting Coolant and Tools

Triple C cutting coolant will be a feature of the display by the Cutting Tool Mfg. Division of the Motch & Merryweather Machinery Co., Cleveland, Ohio. This clear, cool, and clean coolant is water-soluble, harmless to touch, and non-flammable. Non-gumming, non-galling, and anti-rust properties are said to reduce friction and increase tool life. Since the coolant is not oily or greasy, work-pieces are easy to handle. Also, the work-pieces are clearly visible because the coolant is smokeless and foamless. Information on Triple C grinding coolant will also be available.

Other products that will be exhibited include Kroslock face milling cutters and shell end-mills, 3 through 32 inches in diameter; Triple-Chip segmental saw blades up to 84 inches in diameter; Triple-Chip solid saw blades; Triple-Chip slitting and slotting saw blades, 3 through 8 inches in diameter; and Dual Drive adapters for maximum protection to the blades in slitting and slotting operations. Booth 1021.

Circle Item 132 on postcard, page 255

Palmgren angle vise with a swivel base announced by Chicago Tool and Engineering Co.

Palmgren Vises, Rotary Table and Bench Mill

The Palmgren No. 23B angle vise with swivel base recently announced by the Chicago Tool and Engineering Co., Chicago, Ill., will be displayed at the show. This vise permits accurate set-ups to be made quickly at any angle and without the use of clamps, wedges, or other makeshift methods.

The jaws of this vise are 3 inches wide by 1 3/4 inches deep and have a maximum opening of 3 inches. The vise can be used with or without the 360-degree graduated swivel base, and can be set at any angle from 0 to 90 degrees in a vertical plane. It can also be used as an ordinary machine vise in the horizontal position. Other Palmgren products to be displayed are a rotary tilting table, angle and swivel vises, three-way vises and a bench mill. Booth 262.

Circle Item 133 on postcard, page 255

Tree Tool & Die Works Will Exhibit Vertical Milling Machine

A Model 2UVR vertical milling machine designed for use in toolrooms, experimental departments, and pattern shops, as well as production lines, will be exhibited by the Tree Tool & Die Works, Racine, Wis.

Features of this machine include a fully universal head; variable-speed spindle drive; variable quill feed and automatic collet closer; roller spindle drive; spindle brake; enclosed micrometer depth stop; clamp turret lock; built-in power table feed; rapid traverse; and one-shot oiling system. Booth 605.

Circle Item 134 on postcard, page 255

Nichols Milling Machines and Ellis Dividing Head

Nichols-Morris Corporation, of White Plains, N. Y., will display a line of Nichols standard, toolroom, semi-automatic, and twin milling machines, as well as milling machine accessories. The model 8-SA heavy-duty, semi-automatic milling machine seen in Fig. 1 provides spindle speeds up to 5000 R.P.M., and feeds are infinitely variable from 0 to 60 inches per minute, with a rapid traverse of 300 inches per minute. This machine features an 8 1/2 by 30 inch table, a 14-inch pneumatic longitudinal table feed, and a heavy knee and saddle. In addition, the machine can be furnished with pneumatic transverse feed and rise-and-fall spindle movement. The feeds in two directions can be synchronized to produce a fully automatic cycle.

Also to be exhibited is an Ellis double swivel, precision dividing head, Fig. 2, having a swing of 6 1/2 inches (or 11 inches with riser blocks). Indexing accuracy is guaranteed to 1 minute in 360 degrees of rotation, and spindle runout is 0.0004 inch or less when measured at the end of a 12-inch mandrel. Most divisions up to 520

Vertical milling machine introduced by Tree Tool & Die Works

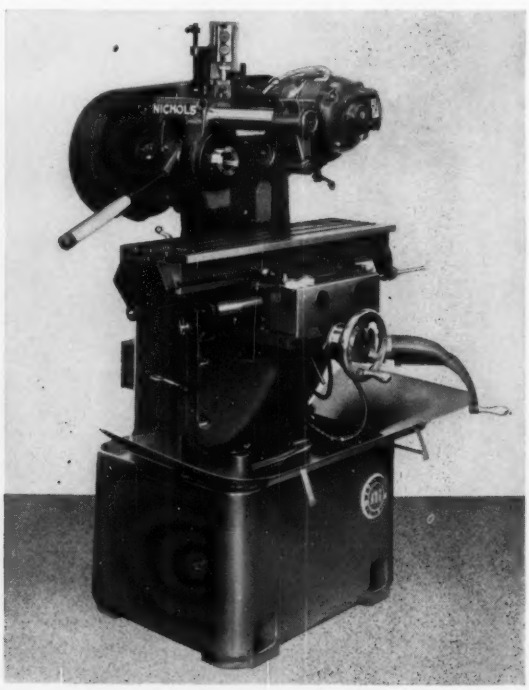


Fig. 1. Nichols heavy-duty, semi-automatic milling machine

Fig. 2. Ellis double swivel, precision dividing head

are obtainable by crank indexing with a 40 to 1 ratio. Instantaneous worm disengagement is provided for direct indexing. A wide selection of extra equipment such as self-centering chucks, faceplates, and a draw-in collet attachment to 3/4-inch capacity is available for use with the head. Booth 351.

Circle Item 135 on postcard, page 255

Federal Products to Exhibit Measuring Equipment

A complete line of the latest dimensional measuring equipment, including electronic, air, electric, and mechanical systems, will be exhibited by the Federal Products Corporation, Providence, R.I. Several of the very latest developments in electronic and air-electric machine control gaging will be on display along with the "Dimensionair" air gages, mechanical dial gages, and dial indicators. One of the highlights of the exhibit will be a new series of dial indicators incorporating precision-hardened gears and pinions.

Machine control demonstrations will show various types of grinder control—cylindrical, center type, and internal. Combined gaging and automatic control for internal grinding will also be shown.

Air-electronic gaging will also be demonstrated by an automatic gage that measures the inside diameter of hydraulic valve-lifter cups and segregates them into six good diameter classifications plus under- and over-size rejects.

Another new instrument to be shown is the "Distometer," a long-range indicating device for use on lathes and other machine tools which accurately measures the travel of the machine carriage in relation to any given point on the machine bed. Booth 496.

Circle Item 136 on postcard, page 255

Modern Industrial Engineering Introduces Machine for Burring and Chamfering Hypoid Gear Teeth

A three-station grinding machine for burring and chamfering both the inside and outside edges of hypoid gear teeth will be introduced by the Modern Industrial Engineering Co., Detroit, Mich. This machine and the latest "Burr-Master" gear deburring and chamfering machines will be exhibited to the public for the first time. Three ring gears are chamfered at a time on the chamfer-grinding machine illustrated, at a production rate of 300 per hour. One operator can easily take care of all three stations.

Two air-driven spindles with small grinding wheels are located at each work-station where the deburring and chamfering operations are performed. The infinitely adjustable counterbalanced spindles, mounted on anti-friction bearings, permit the grinding wheel to be set in proper relation to the gear teeth. One grinding wheel chamfers the inside edges while the other simultaneously chamfers the outside edges. Thus tooth interference is eliminated by the chamfering operations performed while the burring takes place. A chamfer is ground all around the tooth form including the root and toe, the grinding wheel actually being guided around the tooth form by cam action.

The part-holding fixture mounted on the work-station spindle rotates continuously at a slow rate. After a part is placed in the fixture, dual start-buttons located on opposite sides of each work-station are pressed to raise the work into the grinding position and lower the grinding heads.

Upon completion of one revolution of the work-piece, the grinding spindle is automatically raised from the work and the part is lowered for unloading. All three stations function independently but in the same way. A bracket is provided at each work-station for storing the pinion gear while work is being performed on the mating ring gear. Parts of various sizes can be handled on this machine. A variety of straight and spiral bevel gears can be chamfered by proper adjustment of the tools. Booth 613.

Circle Item 137 on postcard, page 255

Three-station machine built by Modern Industrial Engineering Co. for production chamfering both edges of hypoid gear teeth.

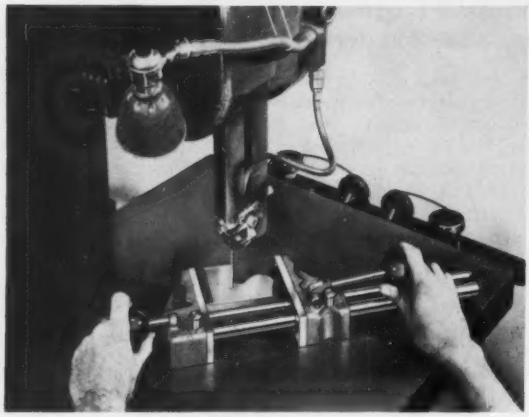


Fig. 1. Heinrich band-saw vise

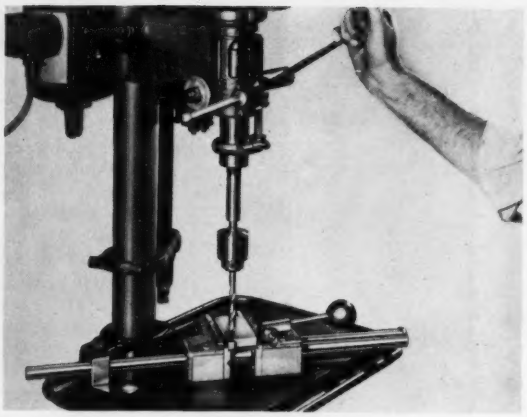


Fig. 2. Safety drill press vise

Heinrich Work-Holding Fixtures and Vises

New products to be displayed by Heinrich Tools, Inc., Racine, Wis., include No. 12WH band-saw vise, Fig. 1; No. 13WH safety drill press vise, Fig. 2; Model 22 self-centering air vise, Fig. 3; and the "Grip-Master" fixture base, Fig. 4, designed for use in building low-cost jigs and fixtures. With the exception of the Model 22 self-centering air vise, these work-holding devices have the "Circle-Grip" locking mechanism for instant setting and positive locking.

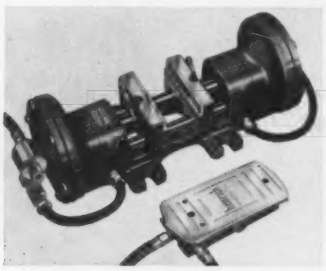


Fig. 3. Heinrich self-centering air vise

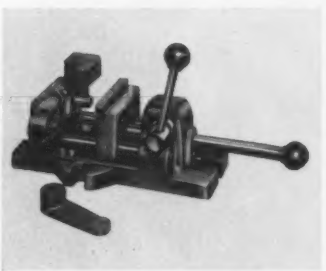


Fig. 4. "Grip-Master" base for low-cost fixtures

The Model 22 self-centering air vise is designed for holding parts that vary in size or shape and which require accurate location of a center or other predetermined point. Heinrich "Handnibs" for shearing, nibbling, punching, and rod cutting will also be displayed. Booth 788.

Circle Item 138 on postcard, page 255

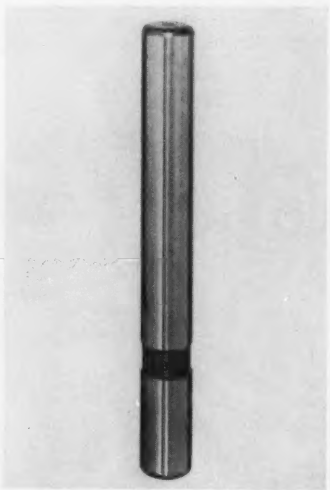


Fig. 1. Guide pin has surface finish of 7 to 9 micro-inches.

Producto Guide Pins and Bushings

Guide pins and bushings designed to improve die-set accuracy, appearance, and performance, will be introduced by the Producto Machine Co., Bridgeport, Conn. The guide pins, Fig. 1, have greater press fit lengths, smoother end radii, and mirror-like surface finishes of 7 to 9 micro-inches. Master bushings, Fig. 2, have greater bearing surfaces, improved accuracy, ground shoulders for square seating and better alignment, and ground leads on the press fit surfaces to facilitate starting the bushings into the punch-holder. Double figure-8 oil-grooves, fed by a grease fitting or spring-loaded grease cup, provide adequate lubrication for the master bushing.

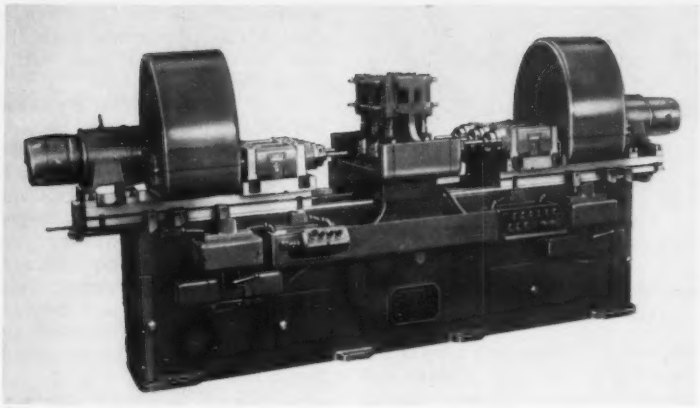
Fig. 2. Master bushing having ground shoulders, made by the Producto Machine Co.

Standard and special die sets, diemakers' accessories, vises, feeding devices, and other tool-room equipment will also be exhibited. Booth 396.

Circle Item 139 on postcard, page 255

Hanson-Whitney Threading Tools and Gages

Cutting tools and gages for precision threading will be exhibited by the Hanson-Whitney Co., Divi-



Two-way boring machine introduced by Simplex Machine Tool Corporation

sion of Whitney Chain Co., Hartford, Conn. Featured will be concentricity attachments for use with external and internal thread comparators, which make possible fast and accurate visual gaging of the thread diameter in relation to the face, periphery, or other surface of the work-piece. Booth 163.

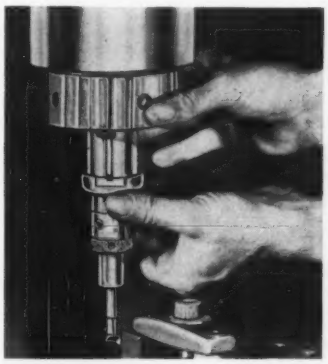
Circle Item 140 on postcard, page 255

Checking Instruments by Chicago Dial Indicator Co.

Precision checking instruments for measuring variations as small as 0.0001 inch will be demonstrated by the Chicago Dial Indicator Co., Chicago, Ill. Included will be dial indicators, test sets, bench centers, magnetic bases, bench gages, and dial snap gages. Geneva dial indicators feature continuous and balanced reading dials for 0.001, 0.0005, and 0.0001 inch graduations; threaded stems for special fixtures; and special internal lever movements which eliminate gears. Booth 1030.

Circle Item 141 on postcard, page 255

Geneva dial indicator graduated to 0.0001 inch and having a range of 0.060 inch in six revolutions.



Boring tool and adapter being inserted in Beaver tool-holder.

Beaver Quick Change Tool-Holders and Milling Cutters

Beaver Tool & Engineering Corporation, Royal Oak, Mich., will demonstrate its line of quick change tool-holders. With these holders, a quarter turn to the right of the locking collar insures positive and rigid mounting of the tool, and a quarter turn to the left releases the tool. Also to be displayed is the line of Eager Beaver milling cutters with inserted type carbide-tipped blades. These cutters can be used for various materials by merely changing the blades. Booth 444.

Circle Item 142 on postcard, page 255

Simplex Precision Boring Machine

A 2U, two-way, hydraulic feed, precision boring machine with six No. 2 precision boring heads and hydraulically clamped work-holding fixture designed to hold six pistons for semi-finish and finish-boring of wrist-pin holes will be one of a number of machine tools exhibited by the Simplex Machine Tool Corporation, Milwaukee, Wis. The operator loads one side of this machine while the other side performs boring operations. The production rate is 375 pistons per hour at 100 per cent operating efficiency. Booth 1612.

Circle Item 143 on postcard, page 255

Pin-mounted two-piece core-drill made by Metal Cutting Tools, Inc.

"Metcut" Pin-Mounted Core-Drill

Metal Cutting Tools, Inc., Rockford, Ill., will have on display a new pin-mounted two-piece type core-drill incorporating a number of new features developed to assure more efficient cutting action and longer, trouble-free service. The new tool consists of a drill body and either a high-speed or carbide-tipped replaceable cutter.

The cutter is secured to the body of the drill by means of a simple Allen head cap-screw and, as illustrated, is accurately positioned and driven by means of four pins located in the center of each flute. The new pin-mount design permits easy hand removal of the cutter and eliminates the gap between the tool and cutter. It is available in 3/4- to 5-inch sizes. Booth 1143.

Circle Item 144 on postcard, page 255

Vascoloy-Ramet facing tool with "throw-away" insert

Vascoloy-Ramet Tools and Cutters

The Vascoloy-Ramet Corporation, Waukegan, Ill., will display a new line of face mill cutters designed around the V-R elevator tool-holder principle. These cutters feature "throw-away" carbide inserts which eliminate grinding. When the cutter is dull, all inserts are quickly indexed to new cutting edges. When the edges are used up, a new set can be quickly installed. This line of milling cutters will be available in 4-, 6-, 8-, and 10-inch diameter sizes.

Three new styles of tool-holders with a positive rake of 6 degrees will be shown for the first time. Style SFPR, designed for facing, has a 15-degree lead angle and a square "throw-away" insert with eight cutting edges. It is also available in a left-hand model, Style SFPL.

The Style SBPR tool, for turning, has a 15-degree lead angle and a square "throw-away" insert, which also has eight cutting edges. Available in a left-hand model as well—Style SBPL. Triangular "throw-away" inserts for facing give six cutting edges and are available in a left-hand model, Style TFPL. Booth 1137.

Circle Item 145 on postcard, page 255

Apex Tools, Holders, and Radius Grinding Fixture

Apex double-locking, shankless, serrated, adjustable holders and tools of the design seen in Fig. 1 will be exhibited by the Apex Tool & Cutter Co., Shelton, Conn. The newly perfected holder and tool illustrated permits extra heavy roughing work to be done on planers with the use of the button type carbide plug. This plug can be indexed many times to bring new cutting edges into the working position before regrinding is necessary. Other standard-shaped tools can be used in this holder for various operations such as finishing, etc. The tools can be interchanged without removing the holder from the machine.

The newly developed radius-grinding fixture, Fig. 2, for redressing tools will also be exhibited. Adapter heads for holding the shankless, round shank, or square tool bits are interchangeable on the fixture, which can be used on any tool and cutter grinder having an infeed.

Other products to be displayed include standard and special tool-holders of the serrated, adjustable, and round shank styles; tool bits of drop-forged, high-speed, and cobalt steel; and carbide-tipped tools. Single- and multiple-purpose milling cutters with tapered, serrated blades, drop-forged of high-speed or cobalt steel, and carbide-tipped cutters for use on steel, cast iron, etc., will also be exhibited. Booth 174.

Circle Item 146 on postcard, page 255

Selas to Demonstrate Heat Processing Equipment

The development of controlled heat processing equipment to serve as a machine tool unit in a production line will be the theme of the exhibit of the Selas Corporation of America, Philadelphia, Pa. To illustrate this principle, Selas will operate a high-speed, pusher type furnace for automatic heating of metal slugs for hot-forming. Automatic feed and delivery, as well as automatic temperature control, will be demonstrated. Stainless-steel slugs 3/4 inch in diameter by 1 inch long will be fed into the fast-heating furnace, and will be delivered at frequent intervals at forging temperature. The equipment is extremely compact, the furnace section being only 40 inches long and the slug-travel through the furnace only 24 inches.

Other heat processing operations featured will be machine

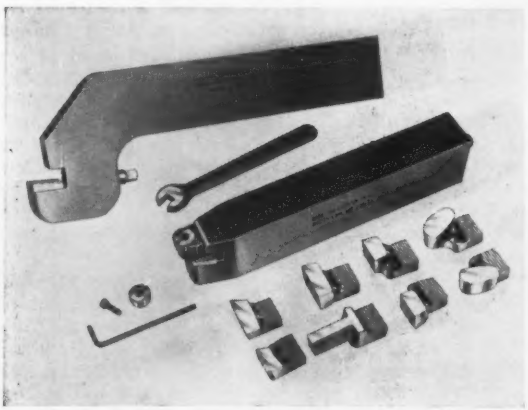


Fig. 1. Apex double-locking, shankless, serrated, adjustable holders and tools

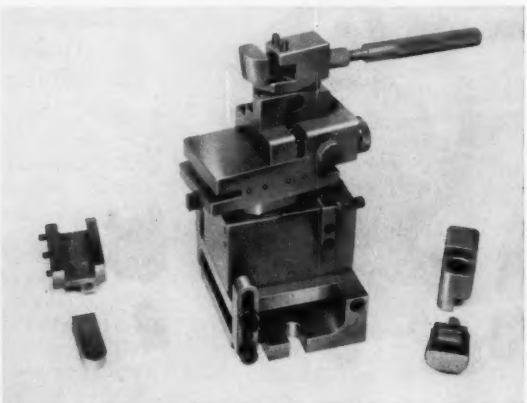


Fig. 2. Radius-grinding fixture for redressing tools to be shown by Apex Tool & Cutter Co., Inc.

brazing and soldering, automatic hardening and annealing, and selective flame hardening. All these heating tools use gas (natural, manufactured, mixed, etc.) pre-mixed with air and pressurized by a gas combustion controller, and burned in specially designed burners employing ceramic lining and flame holders for high-speed, controlled heating. Booth 1218.

Circle Item 147 on postcard, page 255

Roughness Measuring Equipment

The Micrometrical Mfg. Co., Ann Arbor, Mich., will demonstrate versatile, portable equipment, designated "Profilometer Group II," which is designed for measuring surface roughness in the shop. This equipment is said to have the capacity for measuring the roughness of more than 85 per cent of all machined surfaces.

The equipment includes an "Amplimeter," a Type LJ tracer, and a "Mototrace" for mechanical operation of the tracer. The tracer can be used on the surfaces of holes as small as 1/4 inch in diameter and on round work as small as 1/8 inch, flats, tapers, and narrow splines. It can be passed through a 3/4-inch hole. The "Mototrace" provides a smooth reciprocating tracing motion of 0.3 inch per second over any desired length of trace from 1/16 inch to 2 3/4 inches. The "Amplimeter" shows either arithmetical or r.m.s average roughness height, and has six ranges with full-scale readings of 3 to 1000 micro-inches. Booth 774.

Circle Item 148 on postcard, page 255

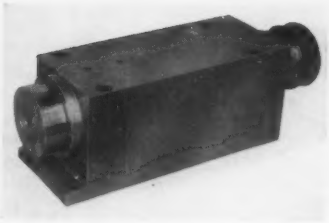


Fig. 1. Pope super-precision heavy-duty boring spindle.

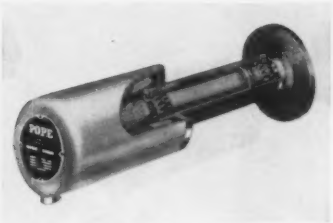


Fig. 2. Motorized totally enclosed grinding spindle.

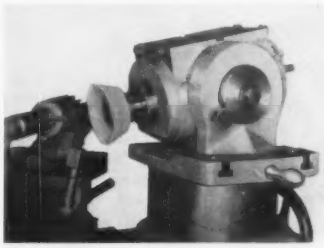


Fig. 3. Pope motorized tool and cutter grinder spindle.

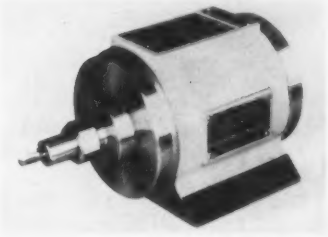


Fig. 4. Super-precision heavy-duty milling and grinding spindle.

Pope Boring, Grinding and Milling Spindles

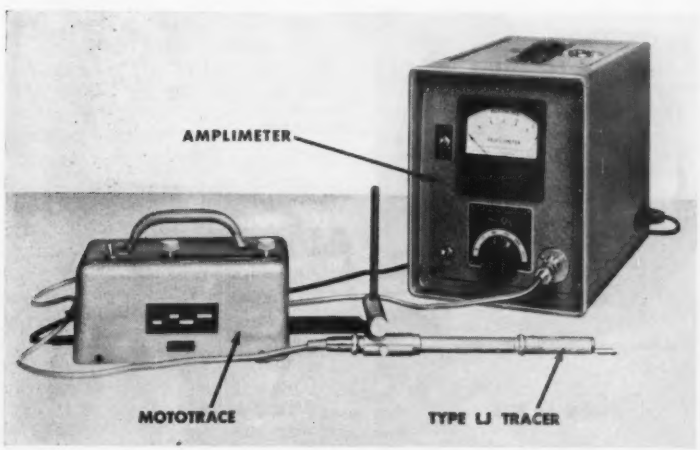
Several new precision spindles manufactured by the Pope Machinery Corporation, Haverhill, Mass., will be exhibited by the Chicago Representatives, Federal Machinery Sales Co. The new Pope super-precision, heavy-duty boring spindle, Fig. 1, which is capable of boring holes within millionths of an inch, comes in both belt- and motor-driven types covering a wide range of speeds and horsepower. Other new Pope spindles of special interest are the high cycle, totally enclosed, water-cooled oil-mist lubricated, motorized spindles for super-precision, heavy-duty grinding and milling at speeds up to 100,000 R.P.M.

The motorized 1-H.P., totally enclosed, non-ventilated, dual-voltage, 3-phase, 60-cycle, 6 by 18 inch surface grinder spindle, Fig. 2, which has a speed of 3600 R.P.M., will be shown with a section of the cartridge cut away to demonstrate the unique bearing set-up—double row cylindrical roller bearings and separate thrust bearings to prevent endwise movement of the shaft. The same type of spindles with high-speed vertical and high-speed horizontal grinding attachments will also be presented.

Featured also will be the Pope motorized tool and cutter grinder spindle, Fig. 3, which provides angular adjustment on both axes and permits the use of cup wheels for practically all clearance angles, resulting in stronger, longer lasting cutting edges; and a wheel-holder for surface grinders and tool and cutter grinders which is quickly detachable and eliminates the need for a wheel puller.

Pope heavy-duty, vee-belt driven precision milling spindles and wheel-heads ranging from 1/2 to 50 H.P., and a number of belt driven, cartridge type internal grinding spindles including those for deep holes will be exhibited. A super-precision high-frequency heavy-duty milling and grinding machine spindle to be displayed is shown in Fig. 4. Booth 392.

Circle Item 149 on postcard, page 255



Micrometrical portable surface-roughness measuring equipment

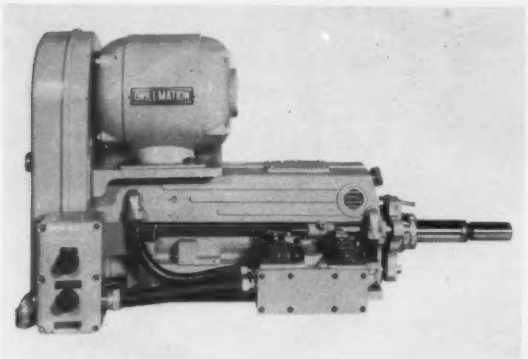


Fig. 1. Drillmation drilling unit

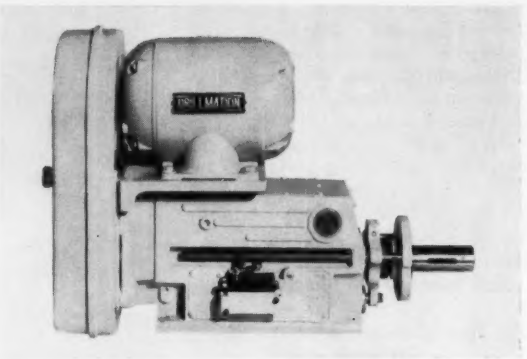


Fig. 2. "Tapmation" tapping unit

Drillmation Drilling and Tapping Units

The Drillmation Co., Hazel Park, Mich., has announced the addition of a deep-hole drilling unit to its machine tool package type power equipment, which will be exhibited. This is a self-enclosed, hydraulic-feed power unit, Fig. 1, designed for deep-hole drilling in crankshafts, camshafts, and similar work.

The drilling steps or increments selected can be pre-set to any depth multiples, and with a rapid approach and return they need no further adjustments. No appreciable heat rise occurs due to a locked-circuit feed. Millions of holes can be drilled with this unit in alloys with a hardness rating of 40 on the Rockwell C scale. The drill spindle and pumps are integral. Standard units have a 10-inch stroke.

A machine tool component for automatic tapping, called the "Tapmation," shown in Fig. 2, will also be exhibited. This unit provides rapid approach of tap to work, then tapping through lead-screw with locked-circuit feed and thrust control, followed by rapid return to the starting point of the cycle.

Operation dependability and greater precision because of bearing and lead-screw oil bath systems are advantages claimed for this unit. The standard Model 555 has a 5-inch quill travel. Tapping capacity ranges up to 7/8 inch in steel under continuous-duty operation. Booth 737.

Circle Item 150 on postcard, page 255

Kurt Orban to Exhibit Automatic Keyway and Slot Milling Machines

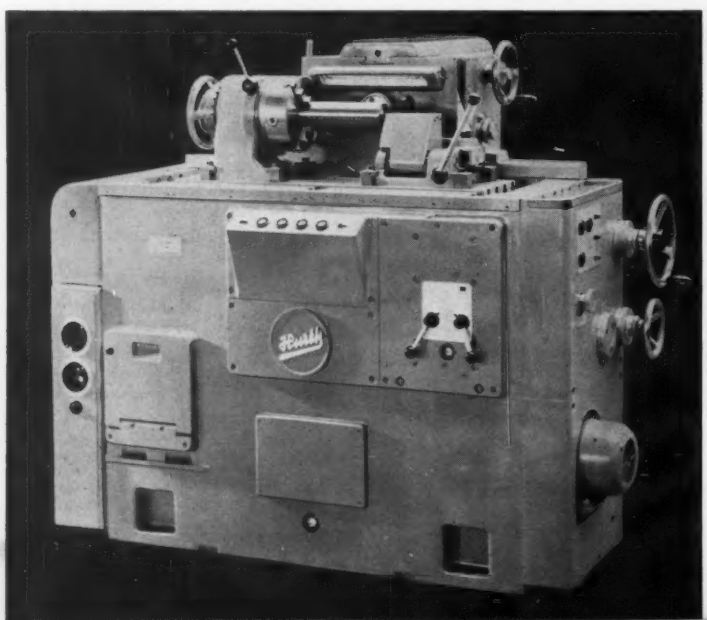
Hurth keyway and slot automatic milling machines will be exhibited by the Kurt Orban Co., Inc., Jersey City, N. J., together with S&F gear testers; Lindner optical jig borer; Trebel dynamic balancer; Schiess vertical turret lathe; and Pegard boring and milling machines.

The Hurth keyway miller shown in the accompanying illustration will be introduced. Operation of this machine is fully automatic. Loading and unloading of the work-piece is the only hand work required.

When the start-button is pressed, the spindle begins rotating and the spindle sleeve moves toward the work-piece in rapid traverse. The cutter then advances to full depth with boring feed. The milling slide next moves downward by half the difference between the width of the slot or keyway and the diameter of the cutter. Then the milling slide moves with normal feed speed to the other end of the keyway, following which the milling slide moves upward by the whole amount of the difference between the width of the keyway and the diameter of the cutter. Quick traverse then moves the cutter back to the starting position, and the milling slide moves down to the center position. Next, the spindle sleeve moves back in quick traverse and the spindle is stopped. These operations are all performed in rapid sequence.

The milling time on a keyway 5/8 inch by 2 inches by 1/4 inch is approximately 1.09 minutes. At the end of the milling cycle, the machine stops automatically; the

Hurth automatic keyway milling machine shown by Kurt Orban Co., Inc.



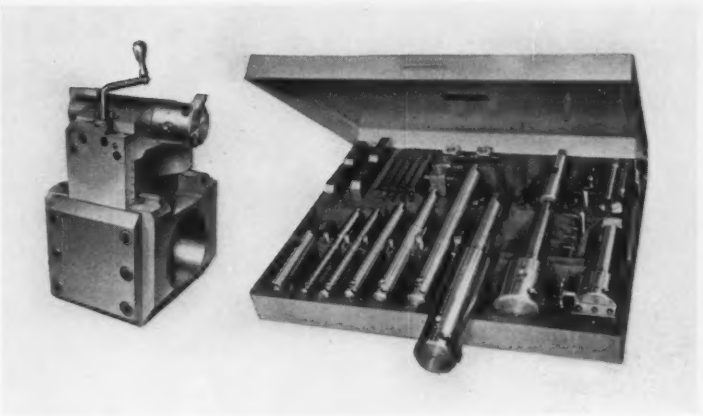
operator changes the work-piece; and a new cycle begins.

Large scales simplify setting the machine for the length, width, and depth of keyways or slots to be milled. Twelve spindle speeds from 180 to 2240 R.P.M. and twelve longitudinal feeds are provided. The work-table is stationary and is an integral part of the machine base. Its normal length is 49 1/2 inches but it can be increased to either 70 or 88 inches to accommodate longer work-pieces. Booth 305.

Circle Item 151 on postcard, page 255

Davis Tools to be Exhibited by Giddings & Lewis

The Davis Boring Tool Division of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., will exhibit a line of Davis tools that includes carbide-tip planer tools; L-type boring tools; 8-position tool-holders; quick-change arbor and sleeves; line-boring bar with 3 and 1 boring head; stub boring tools with unfinished shanks; and interchangeable block type tooling.



Davis extension boring head and set of micrometer adjustable stub boring tools to be exhibited by Giddings & Lewis

In addition to these tools, the extension boring head and the set of micrometer adjustable stub boring tools shown in the accompanying illustration will also be on display. Booth 489.

Circle Item 152 on postcard, page 255

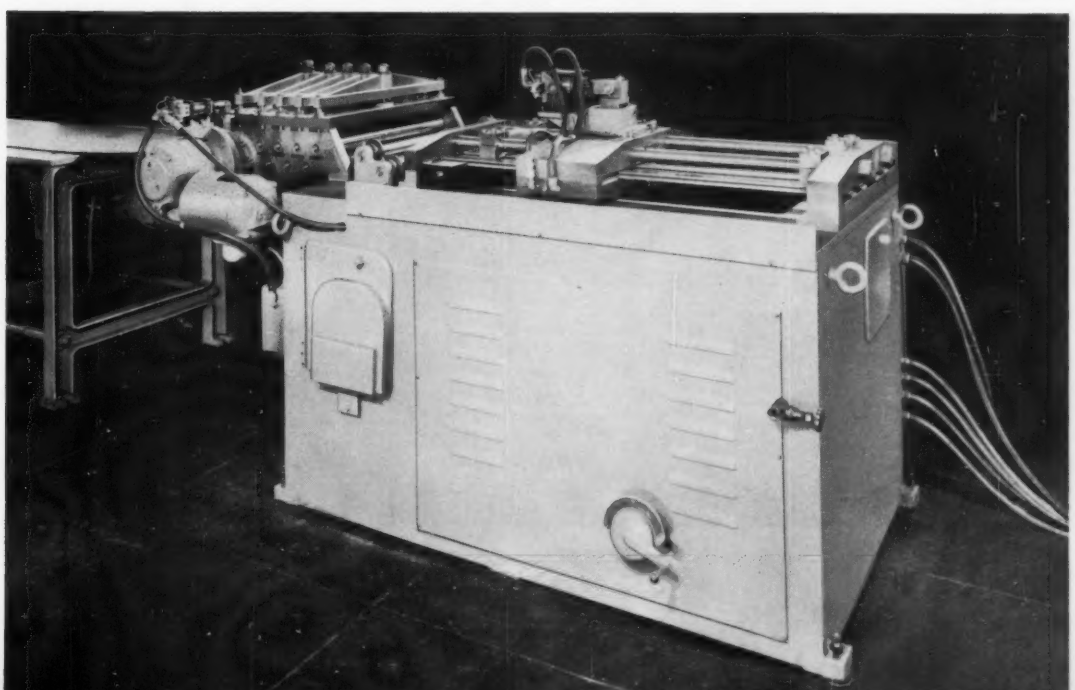
U. S. Tool Exhibits New Equipment

Air-operated and mechanically driven slide feeds, multi-roll coil cradle, cabinet-mounted motor-driven slide feed, and a combination coil cradle and power-driven straightener will be demonstrated for the first time by the U. S. Tool Company, Inc., Ampere, N. J.

The cabinet-mounted, motor-driven Model SFC-24-24 U. S. slide feed, Fig. 1, is equipped with an eight-roll, plain stock straightener and a pair of motor-driven take-in rolls. The independently driven slide feed is designed for feeding coil stock into punch presses or press brakes. Since it is individually driven, it can be used for feeding in any direction: right to left, left to right, front to back, or back to front. This unit will handle stock up to 24 inches wide. The feed length is adjustable up to 24 inches per stroke.

A 5-H.P. motor with variable speed control furnishes the driving power. Equipment includes an electric clutch and brake and an electrically controlled, air-operated check arranged to permit the use of pilots. The unit is controlled from the press by a cam and connections supplied by the user. Since this is an individually motor-driven unit and there are no mechanical connections to the

Fig. 1. U. S. Tool cabinet-mounted slide feed with straightener



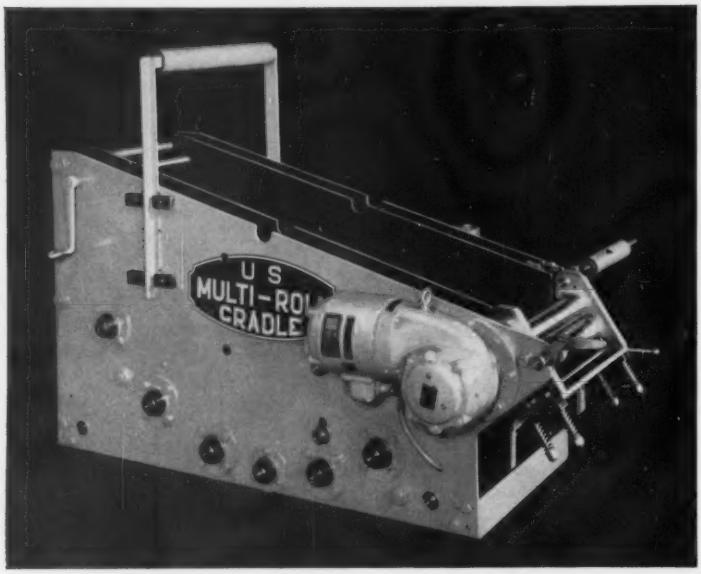


Fig. 2. Multi-roll coil cradle made by U. S. Tool Company

press, it can be used wherever it is needed in the shop.

The multi-roll coil cradle Model ACC-16-48 U. S., seen in Fig. 2, will handle material in widths up to 16 inches, and coils with outside diameters up to 48 inches, weighing up to 3200 pounds. This cradle has two side frames that are adjustable for stock width, six coil rest rolls (four power-driven and two idler), one pair of power-driven take-out rolls (take-out rolls are hinged for easy loading of coils, and quick clamping arrangement provides for threading end of coil), micro-switch loop control, time-delay relay, and 1 1/2-H.P. geared motor for operation on 220 and 440 volts, 3-phase, 60-cycle alternating current. A similar machine for handling material 9 inches wide in coils up to 40 inches in diameter will also be exhibited.

The latest addition to the company's line of mechanically driven slide feeds is the Model SF-24-24, Fig. 3. This feed is suitable for material up to 24 inches in width, and the feeding length is adjustable up to a maximum of 24 inches at one stroke. A roller check and two-piece adjustable driving eccentric is included with this feed. The small Model SF-00 feed, shown in the lower right-hand corner of Fig. 3, has a capacity for handling material up to 1 1/2 inches in width and feeding length that is adjustable up to 1 inch. Booth 375.

Circle Item 153 on postcard, page 255

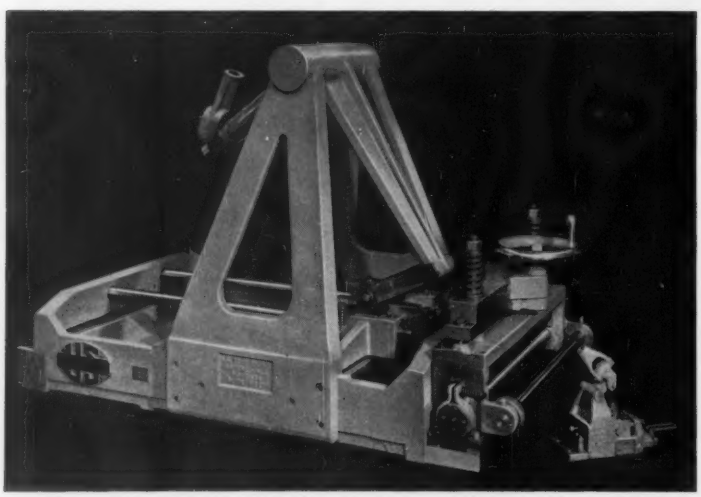


Fig. 3. Model SF-24-24 and (lower right) Model SF-00 slide feeds

Ryerson Mechanized Flame-Cutting Process

A demonstration of mechanized flame-cutting of plain and irregular shapes from steel plate, employing the electronic eye tracer, plus a machining operation performed on shapes flame-cut from new "E-Z-Cut" steel plate, will be features of the display by Joseph T. Ryerson & Son, Inc., Chicago, Ill. The company's recently developed "E-Z-Cut" steel plate will also be shown. This material is especially suited for making die bases, jigs, molds, and other products in which considerable machining is involved. The operation will demonstrate the greatly improved machinability of the new "E-Z-Cut" steel plate. Booth 1400.

Circle Item 154 on postcard, page 255

Hause Drilling Equipment

Hause Engineering, Montpelier, Ohio, will display a double-end machine, a deep-hole drilling Holomatic unit, and an automatic drill press in actual operation.

The Hause double-end machine is designed to perform special drilling, tapping, and other work done by tools of the end-cutting type. This machine incorporates two Model 24 Holomatic drill units, a welded steel base, and complete air and electric power and cycle control systems.

Rapid travel movements, feed rates, and stroke lengths are adjustable in both the advance and retract motions. The maximum stroke length per unit is 4 inches, and the maximum work capacity is 2 H.P. Spindle speeds from 190 to 10,000 R.P.M. are available. The long, wide top of the machine base permits the opposed Holomatic units and fixtures to be offset or set at an angle, and to be spaced up to 35 inches apart to suit the work being handled.

The Model 24 Holomatic drill unit, when equipped with the new F222C deep-hole drilling attachment, is an extremely efficient deep-hole drilling machine. The

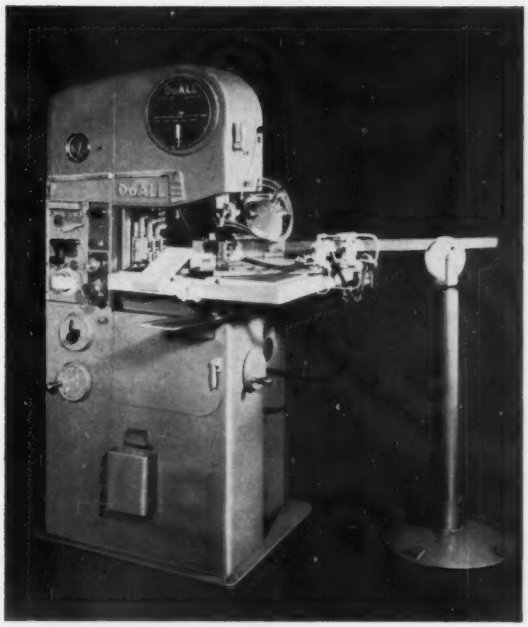


Fig. 1. DoALL band machine arranged for automatic angle cutting of stacked bars

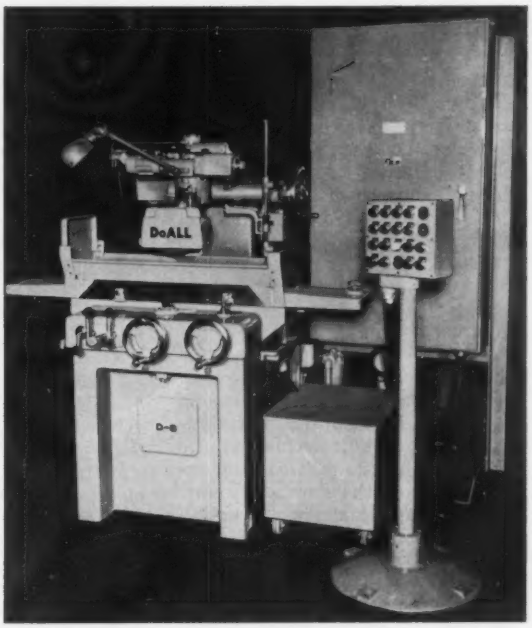


Fig. 2. DoALL automatic surface grinder equipped for form grinding of precision parts

attachment fits all late model Holomatic units and can be factory installed on new units or obtained as a kit for field installation on existing Holomatic units. Holes from approximately 0.025 to 5/8 inch in diameter can be drilled in mild steel up to a depth of 3 3/4 inches. The positive acting hydraulic control of the spindle travel in both rapid and feed movements allows the drilling of work-hardening materials such as stainless steel as well as extremely soft materials such as copper. Booth 246.

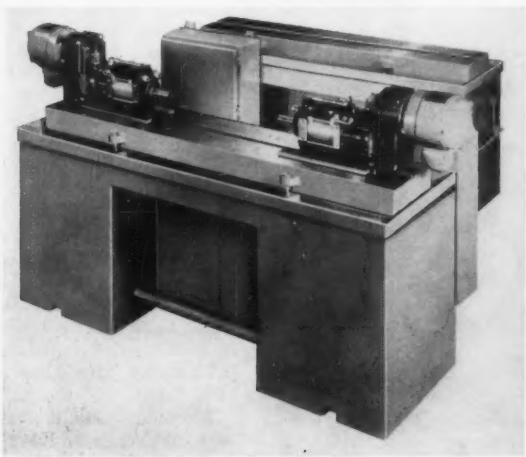
Circle Item 155 on postcard, page 255

Automatic Production Sawing to Highlight DoALL Display

Completely automatic angle sawing of stacked bar stock will be featured on a DoALL 16—3 "Contour-matic" band machine, Fig. 1, to be exhibited by The DoALL Co., Des Plaines, Ill. In this operation the stacks are indexed, the hydraulic feed table moved forward on the cutting stroke, and the cut pieces ejected automatically to achieve fast production rates. High-production machining of duplicate parts using simple fast-loading fixtures will also be conducted on the Model 26—3 "Contour-matic" band machine. Demonstrations will show how various operations can be performed rapidly and with little material waste, on the semi-automatic band machine using Demon high-speed steel saw bands. This approach to machining exploits the unique band machine principle of removing unwanted material in whole salvable sections by cutting directly to the outline of the part. Time-consuming clamps and hold-downs are eliminated because of the constant downward pressure exerted by the cutting tool. Parts of diverse form and size will also be shaped, slotted, notched, parted, and trimmed.

The reliability of surface grinder controls reflected in the ability to remove exactly corresponding amounts of material, will be demonstrated by a DoALL surface grinder equipped as shown in Fig. 2. This machine will be arranged for "automatic downfeed." Forms will be ground to the desired dimensions and finish on a production basis with negligible human control down to the final cut.

An outstanding feature of the exhibition will be the "Micro-



Hause double-end machine for drilling and tapping

tomatic" precision slicing machine, capable of parting and slicing extremely brittle, crystalline materials such as germanium and silicon. This machine was originally developed to cut the precise tiny crystals used in transistors and the larger crystals used in power supply units.

In addition to a complete line of measuring tools, the DoALL patented "Micro-Step" gaging system and the square block gaging accessories for assembling rectangular or square blocks into working gages of every size and description will be demonstrated. DoALL granite surface plates and Bausch & Lomb optical comparators, distributed exclusively by the DoALL organization, will occupy part of the gaging display.

The complete range of DoALL cutting tools, tool steel and other industrial supplies will also be featured. This display will include "finish ground end-mills" so called because the entire cutter, including the flutes, is ground after hardening. Also included will be DoALL's XL drills. Booth 1520.

Circle Item 156 on postcard, page 255

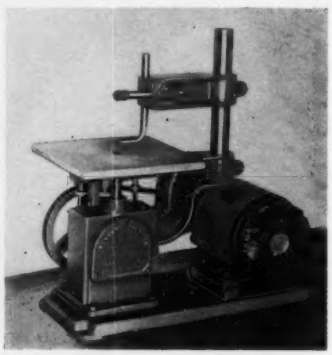
Zagar Gearless Head for Drilling Circuit Boards

A newly developed series of close-center, gearless drill heads for drilling printed circuit boards will be shown for the first time by Zagar Tool, Inc., Cleveland, Ohio. This simplified version of Zagar's gearless drill heads permits easy changing of the hole patterns to be drilled, thus making possible efficient handling of limited production runs and varying wiring patterns by multiple-spindle drilling.

Formica sheets are used in the new drill head for the guide and drive plates, the hole pattern of the printed circuit being drilled simultaneously in three Formica plates. The Formica plates can be removed and stored for future use and replaced with plates provided with new hole patterns as required. The spindles can be closely grouped with a space of only 0.140 inch between them. The maximum group capacity range is a rectangular pattern 6 by 14 inches. This series of drill heads is not designed for large runs where a special head could be economically employed.

Other Zagar gearless, multiple-spindle drill heads of varying sizes and drill patterns; horizontal and vertical broaching machines; collets; collet pads; collet blanks; indexing fixtures; collect lathe chucks; and manually and air operated holding fixtures will also be exhibited. Booth 179.

Circle Item 157 on postcard, page 255



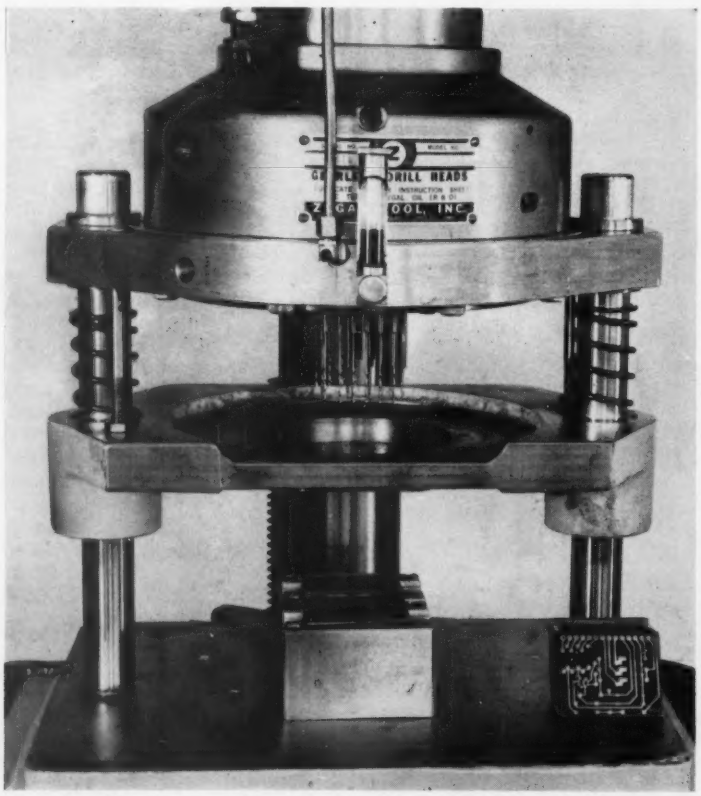
Keller die-filing machine

Keller Die-Filing Machine

A Keller die-filing machine designed for use in tool and die departments, as well as machine, repair, and maintenance shops, will be shown by the Sales Service Machine Tool Co., Minneapolis, Minn. This machine has a self-compensating chuck of wide capacity which will hold files ranging in size from a 1/8 inch diameter round file up to a rectangular-shaped file 1/2 by 5/8 inch. The file roller support has a full 6-inch adjustment for maximum accuracy when using long files. The table has a large work-table area of 8 1/2 by 8 1/2 inches with room for clamping guide blocks, etc.

The table can be tilted up to 15 degrees in any direction and four knurled thumb-screws lock it at the desired angle. Two speeds of 350 and 450 strokes per minute and a stroke length of 1 1/2 inches are available. The scotch yoke mechanism is splash lubricated, and the main shaft is equipped with Oilite bearings. The machine is furnished complete with 1/4-H.P. motor which has a speed of 1800 R.P.M.

A deluxe model is available with both file roller support and overarm for filing, sawing, and lapping. The standard model, as illus-



Zagar gearless multiple-spindle head for drilling printed circuit boards

trated, is equipped with file roller support or with over-arm. A low-cost economy model without file roller or supporting arm is also available. Booth 393.

Circle Item 158 on postcard, page 255

Scully-Jones to Exhibit New Products

"Safe-Torque" tap drivers of new and improved designs, in both non-reversing and reversing types, will be featured in the exhibit of Scully-Jones & Co., Chicago, Ill. These tap drivers will be demonstrated in drill press set-ups for tapping blind holes in aluminum and steel. "Safe-Torque" nut-runners will be operated by air power tools.

"Roll-Lock" and "Better-Hold" chucking tools and pin arbors will be set up to demonstrate their accuracy and high holding power. The "Scully-Drift" will be demonstrated, and a "Toolitrol" board display will show how at-the-machine problems of pre-setting, storing, and changing tools in multiple spindles are co-ordinated to reduce set-up, down, and inspection time.

"Lock-and-Eject" collet or chuck type tools, also of new design, will be exhibited. Light gages for inspection of tapers will also be on display. Booth 488.

Circle Item 159 on postcard, page 255

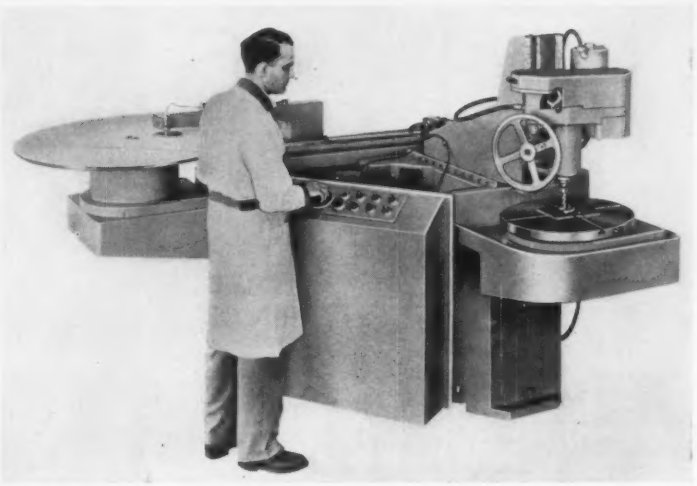


Fig. 1. New England Model 104 template and cam machine

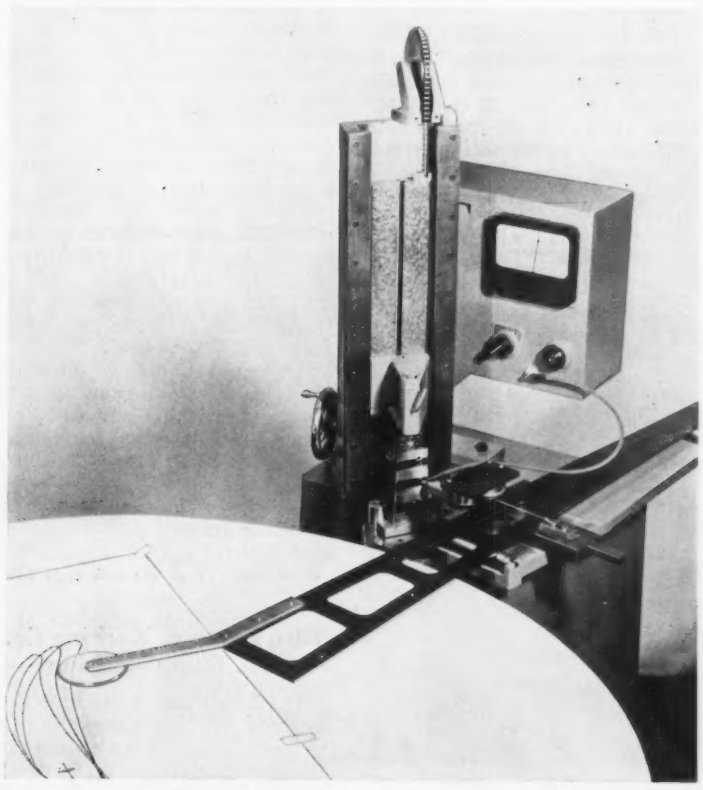


Fig. 2. New England Model 105 airfoil measuring machine

Generating and Measuring Equipment

The New England Machine & Tool Co. Berlin, Conn., will exhibit three new machines to be sold through the sales organization of the Pratt & Whitney Co., Inc., West Hartford, Conn. Two of the machines to be shown are special-purpose, tracer-controlled types which utilize an original non-contacting tracer.

The Model 104 electronic template and cam machine, Fig. 1, generates external and internal contours on cams, templates, blanking punches, and dies by following an enlarged conductive line drawing. Because of its ability to reproduce contours from an easily prepared drawing with excellent precision, it eliminates much hand work. A wide range of spindle speeds, 48 to 11,500 R.P.M., permits milling tough materials with large cutters and fast milling with carbide cutters. It also makes the machine adaptable to grinding operations.

The Model 105 airfoil measuring machine, Fig. 2, a direct-reading, single-operation device for inspecting airfoil contours on jet-engine blades and parts of similar shape, will also be demonstrated. This machine measures errors directly from the 10 to 1 ratio glass (or vinyl) charts which are used as the basic data, starting with the design and following through all stages of manufacture in producing the irregular and twisted contours of the jet-engine blades. Booth 461.

Circle Item 160 on postcard, page 255

Fig. 1. "Talyrond" measuring instrument to be exhibited by the Engis Equipment Co.

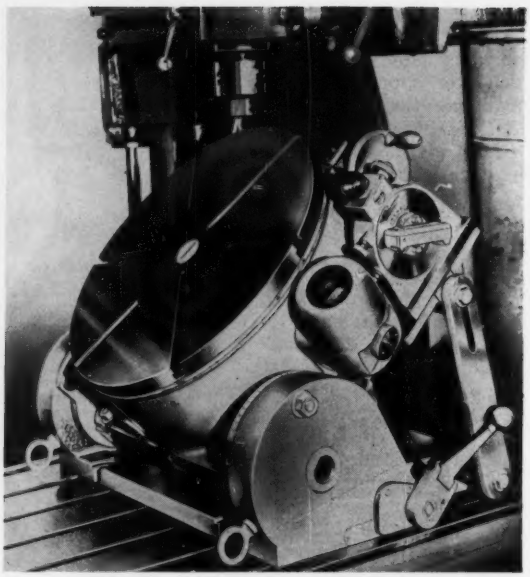


Fig. 2. "Microptic" circular table projection model featured in Engis exhibit

Engis Equipment to be Shown

The Engis Equipment Co., Chicago, Ill., will have on display a new "Talyrond" measuring device, Fig. 1. The performance of this electronic machine in measuring the roundness of parts such as balls, rollers, pistons, cylinders, bearing races, etc., will be shown by samples and test graphs. Radial magnification is variable from 50 to 10,000 depending on depth below top of work. With the part to be tested held stationary, the ultra-precision spindle holding stylus and pick-up produces a permanent record.

The 18-inch circular table projection model "Microptic," Fig. 2, has an optical projection unit built into the table that is completely sealed from dust, oil, and the heat of the lamp. The optical micrometer breaks down the ten-minute divisions on the main glass circle into 200 parts, to give a direct reading to three seconds. Estimation can be made to one and one-half seconds. The main circle is graduated on a Watts precision dividing machine. The top surface of the table is flat, and parallel to the base within 0.0003 inch. Provisions can be made for mounting the circular table on an inclinable table, controlled by a "Microptic" precision clinometer that reads directly to ten seconds. (Estimates to three seconds are possible.)

Fig. 3 shows units available with glass or metal scales, reading directly from 0.0005 to 0.0001 inch which are adaptable to various scale and projector positions, distance, and available mounting space will be exhibited.

A complete range of diamond compounds for fine grinding, lapping, and polishing, and a Di-Profiler reciprocating type hand-operated machine for finishing straight or curved surfaces, small holes, dies, molds, and regular or irregular drawing dies will be included in the exhibit. Booth 1020.

Circle Item 161 on postcard, page 255

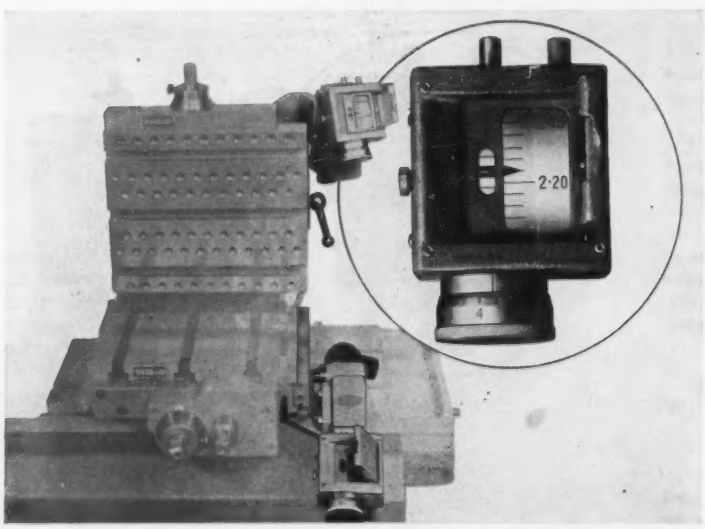


Fig. 3. Scales and projection units for machine tools shown by Engis Equipment Co.

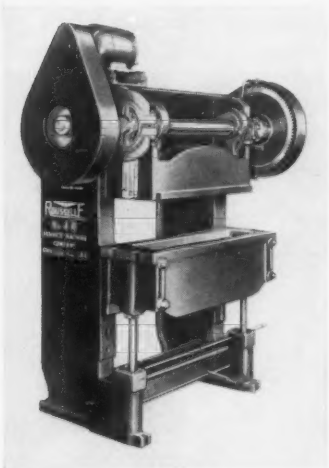
Rice Pump & Machine Co. Die Filing Machine

The Rice Pump & Machine Co., Belgium, Wis., will show its new heavy-duty floor type die filing machine which has been under development for several months. This machine will saw and file to the

center of a 26-inch circle and has a clearance of 6 inches below the over-arm.

A construction feature is the tilting, powered arbor which permits the operator to work on a level table. This table may be tilted when sawing and filing compound angle work. The machine has variable speeds from 80 to 350 strokes per minute and the stroke length is variable from 0 to 5 inches. The over-arm is power actuated, thus qualifying the machine for large work. Booth 264.

Circle Item 162 on postcard, page 255



Rousselle double-crank press with adjustable bed

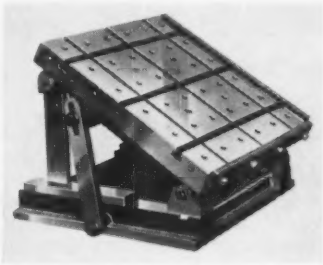
Service Machine Company Exhibits Rousselle Presses

Representative models of the Rousselle line of punch presses will be exhibited by the Service Machine Co., Chicago, Ill. These will include the No. 2 open-back inclinable press of 15-ton capacity; the Model 3G deep-throat press of 25-ton capacity; the No. 4W double-crank gap press of 40-ton capacity with adjustable bed as shown in the illustration; and the No. 15H horn press of 15-ton capacity. Booth 1506.

Circle Item 163 on postcard, page 255

Robbins Heavy-Duty Sine Plates

A complete line of angular tooling equipment will be exhibited by the Omer E. Robbins Co., Detroit, Mich. The line includes heavy-duty sine plates for angular machining; the "Magna-Sine" magnetic sine table for angular grinding; and the Robbins inspection sine plate. All of this equipment has been redesigned during the past year, and new sizes have been added. Prominent among new features is the patented "Perma-Flat" swivel block, which is said to insure



Robbins heavy-duty 12-inch square sine plate.

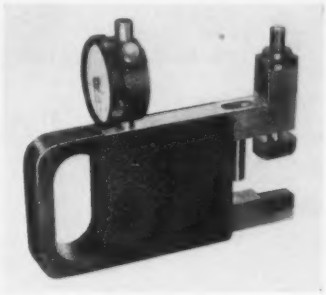
greatly extended service life both for the equipment and the precision gage-blocks which are used with it. Booth 416.

Circle Item 164 on postcard, page 255

Northwestern Step Block and Clamp Sets

The Northwestern Tool & Engineering Co., Dayton, Ohio, will exhibit a new line of step block and clamp sets that will be available for hold-down bolts in sizes from 3/8 through 1 inch in diameter. Three of the most popular sizes—the 1/2-, 5/8-, and 3/4-inch—can be furnished with heavy-duty step blocks 1 1/2 inches wide. These heavy-duty step blocks are also new items. Booth 301.

Circle Item 165 on postcard, page 255



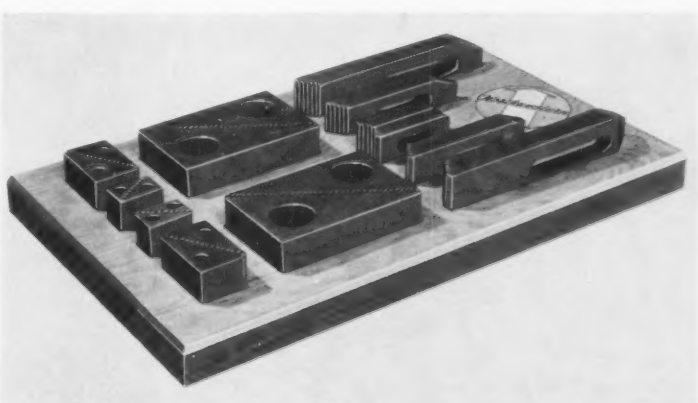
Nilco economy dial snap gage

Nilco Gages

Four new dial gages will be exhibited by the Nilsson Gage Co., Inc., Poughkeepsie, N. Y., including a "Rotable Cam" dial snap gage. This gage has a range of 1 inch and an easy-locking device which can be set without the aid of wrenches. The adjustable anvil remains perfectly parallel over a 1-inch travel.

The Nilco economy dial snap gage illustrated has a range of 1 inch and is designed to operate in coolant or soluble oils without losing its accuracy. A spiral groove gage, also to be shown, utilizes interchangeable jaws for checking groove diameters, thread pitch diameters, ball race diameters, etc. This instrument is said to provide positive gaging accuracy to 0.0001 inch over a range of 6 inches. A scribing gage which can be set to 0.001 inch within a 12-inch range can be used as a lay-out gage, height gage, or test indicator. This gage does not require gage-blocks or masters for accurate setting. Booth 717.

Circle Item 166 on postcard, page 255



Step blocks and clamp sets to be displayed by the Northwestern Tool & Engineering Co.

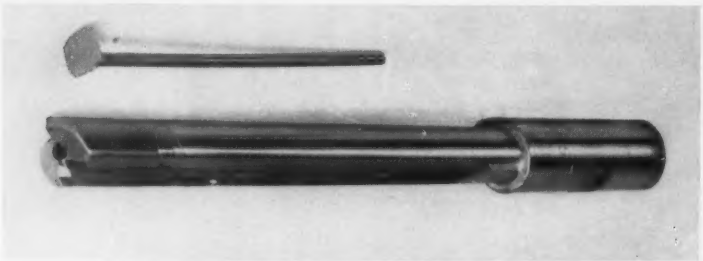


Fig. 1. "Starbore" drill to be displayed by the Star Cutter Co.

"Starbore" Drill for Producing Holes at High Feeding Rates

A "Starbore" drill that produces precision through-holes from the solid at feeds up to 60 inches per minute in cast iron, aluminum, bronze, and steel parts will be exhibited by the Star Cutter Co., Farmington, Mich. This will be the first public display of this carbide-tipped tool of radically new design which, in a single operation, produces holes within tolerances of 0.0002 inch and surfaces as smooth as 4 micro-inches at a feed of 15 inches per minute.

"Starbore" drill, Fig. 1, has a patented off-center hole design, illustrated diagrammatically in Fig. 2, that combines the advantages of an oil-flute drill with those of a trepanning tool. These drills will be demonstrated on a conventional horizontal boring machine. Cast-iron parts will be drilled on a production set-up at feeds up to 60 inches per minute. A test table having a surface finish gage, an air gage, and Carboloy machinability computer will be in the booth to authenticate the consistent dimensional accuracy and finish of the parts produced. Accurate, unground form hobs and multiple-thread milling cutters, as well as a variety of other special milling and forming cutters will be exhibited. Booth 1329.

Circle Item 167 on postcard, page 255

Tinius Olsen Balancing and Hardness Testing Equipment

Demonstrations of balancing and hardness testing equipment will be features of the exhibit to be presented by the Tinius Olsen Testing Machine Co., Willow Grove, Pa. The "Vibrodyne" portable balancer and the "Electrodyne" static balancing equipment for rapid mass-production balancing will be shown. The hardness testing equipment display will include the transportable "Pentrascope" and the air-operated, semi-automatic "Air-O-Brinell" hardness tester.

The "Air-O-Brinell" provides positive application of standard Brinell loads of 500, 1000, 1500, 2000, and 3000 kilograms. An accurate gage mounted at the top of the machine shows exactly what load will be applied before the test is made.

To use the "Air-O-Brinell," the operator simply adjusts the air-pressure regulator valve until the desired Brinell load is indicated on the gage. Once the load is set, any number of hardness tests can be made in rapid succession. The load is applied by operating a plunger type control valve.

The machine need only be attached to a standard compressed air supply line. Fluctuations in the air supply pressure above 65 pounds per square inch will not affect the accuracy of the testing machine. The compactness and accuracy of hand-operated machines are combined with the operating ease of the more expensive motor-driven models in this Brinell tester to adapt it for use in the laboratory as well as on the production line. Booth 566.

"Air-O-Brinell" hardness tester introduced by the Tinius Olsen Testing Machine Co.

Circle Item 168 on postcard, page 255

Oakite "Rustripper"

Oakite "Rustripper," an alkaline compound that removes rust, oxide scale, paint and shop soils without changing dimensions of precision parts or causing hydrogen embrittlement, will be displayed by Oakite Products of Canada, Ltd., Toronto, Ontario, Canada. It is claimed that this product can be used in hot or cold water solutions, with or without current and with or without cyanide.

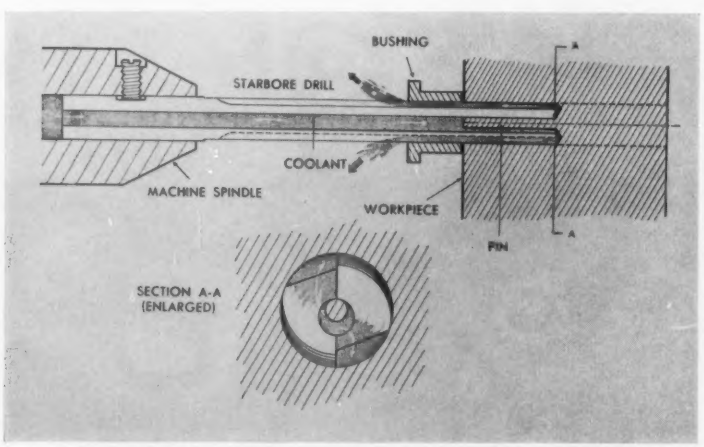
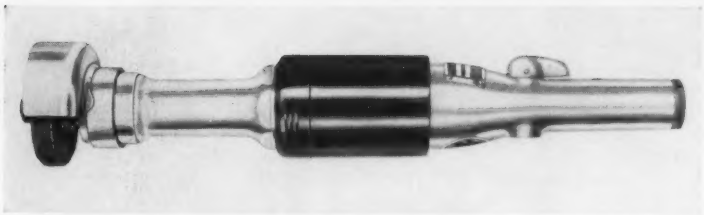


Fig. 2. Diagrams showing new design feature of "Starbore" drill.



A highly sensitive governor is featured on Buckeye abrasive tools.

The compound does not attack sound metal and all action stops as soon as the rust has been removed. It is said to provide temporary protection against rerusting; does not require special equipment; creates no troublesome fumes; and its disposal requires no more precaution than that of any highly alkaline solution.

Oakite soluble oil for machining, grinding, and cutting; special drawing compound and Oakite Composition No. 12 for drawing and forming; alkaline solvent; and acidic detergents for production and maintenance cleaning will also be exhibited. Booth 1325.

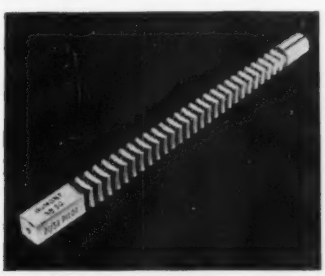
Circle Item 169 on postcard, page 255

duMont Push Type Broaches

The duMont Corporation, Greenfield, Mass., will exhibit its line of standard "Minute Man" square and hexagon, push type broaches. Starting with a round pilot, these tools will finish square or hexagonal holes in drilled, reamed, or cast bores in one pass requiring less than a minute. The tools can be used in either a hand-operated arbor press or a hydraulic press. They are available in eight sizes, for holes from 3/16 to 3/4 inch.

Also to be displayed are keyway broaches, special broaches, magnetic gage bases, super high-speed ground tool bits, and hand-operated arbor presses. Booth 1106.

Circle Item 170 on postcard, page 255



"Minute Man" push type square broach displayed by duMont.

Buckeye Portable Air Tools

A line of portable, air-powered abrasive tools, designated X-4 models, will be introduced by Buckeye Tools Corporation, Dayton, Ohio. Included in the line are horizontal grinders and buffers, vertical grinders and sanders, and right-angle sanders. A special feature is a highly sensitive governor which enables the tools to develop great power and to maintain high speeds under load. The tools weigh no more and are no larger than previous models. Existing Buckeye D, E, and F series abrasive tools can be modified to obtain this improved performance. Booth 113.

Circle Item 171 on postcard, page 255

"Tiny-Titan" tool combines magnetic base, magnifier, and lighting unit.

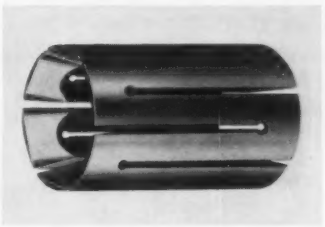
Enco Magnetic Base Magnifier

A combination magnetic base, magnifier, and lighting unit will be featured by Enco Mfg. Co., Chicago, Ill. This "Tiny-Titan" tool has a magnetic base with 65 pounds pull that is 1 1/4 by 1 7/16 by 1 1/2 inches. The double-lens magnifier is 2 inches in diameter, has 5× power, and can be adjusted to any angle or plane. One 25 watt and one 40 watt bulb are included with the lighting unit, which can be used for viewing lay-outs or parts. Booth 651.

Circle Item 172 on postcard, page 255

Woodworth "Tork-lok" Collet Arbor

The N. A. Woodworth Co., Detroit, Mich., will introduce a new approach to collet chucking with the "Tork-lok" collet arbor. Inclined flat surfaces in both the collet sleeve and arbor shaft of this new work-holding device take the place of the conventional conical surfaces, eliminating inherent



"Tork-lok" collet arbor introduced by N. A. Woodworth Co.

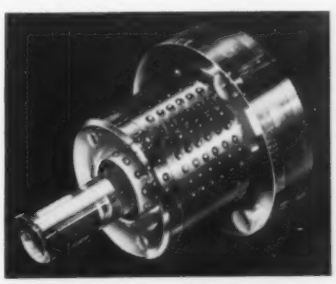
imperfections of the latter design. The flat surfaces of the new collet arbor maintain full area contact at all times, thus assuring a positive drive. Built-in safety stops control both expansion and contraction. Since overexpansion is impossible, collet breakage is reduced. Contraction is restricted to maintain a metal-to-metal seal.

This new collet arbor will be stocked in three styles designated "between center," "flange-mounted draw-bar," and "air-operated draw-bar." Seventy-eight collets are available in capacities ranging from 0.500 inch to 2.562 inches in diameter. Booth 412.

Circle Item 173 on postcard, page 255

Briney Boring Quills

A line of six standard boring quills and plastic models of special quills will be shown by the



Briney boring quill permits rapid adjustment to 0.0001 inch.

Briney Mfg. Co., Pontiac, Mich. These Size-Positive quills incorporate a unique principle consisting of a bushing mounted on preloaded ball bearings between the flange and boring bar. The hole in the bushing is eccentric with its outer surface. A flange locked to the bar by an integral pin and lock-nut unit drives the boring bar. Inertia and spring tension prevent slippage. Rapid adjustment is possible, and the bushing is graduated in 0.0001 inch increments. Booth 159.

Circle Item 174 on postcard, page 255

Starrett to Exhibit Many New Tools

The L. S. Starrett Co., Athol, Mass., will exhibit eighty-five tools that have been added to the line of measuring instruments.

One of the tools to be introduced is the No. 20 "Mul-T-Anvil" micrometer shown in Fig. 1. This tool will give a wide variety of measurements, impossible to obtain with regular micrometers. It is furnished with two interchangeable anvils—a rod anvil approximately 0.120 inch in diameter and a flat anvil 0.125 and 0.060 inch thick at opposite ends.

Micrometers are available in two sizes with ranges of 0 to 1 inch and 1 to 2 inches and have 0.001-inch graduations. They feature balanced design, no-glare satin chromium finish, hardened and ground spindle, "Hi-Micro" lapped anvil and spindle faces.

The patented No. 818 automatic center punch, Fig. 2, another new product to be displayed, features a lightweight aluminum handle designed for effortless handling and an automatic striking mechanism with adjustable striking force. No hammer is needed to use this center punch; simply press the handle and a built-in mechanism strikes a center mark.

A complete new line of power and hand hacksaw blades, developed and tested in the Starrett Metallurgical and Production Testing Laboratory, will also be on display. Each of the three new types of blades to be shown has special characteristics developed for faster, easier cutting and longer blade life on a wide range of cutting work. To make it easy to select the right blade for any job, a distinctive color-identification system and easy-to-remember trade names are employed.

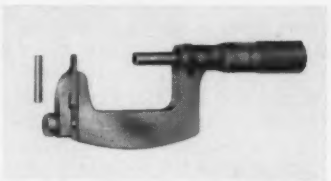


Fig. 1. "Mul-T-Anvil" micrometer to be displayed in Starrett exhibit

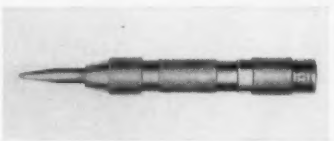


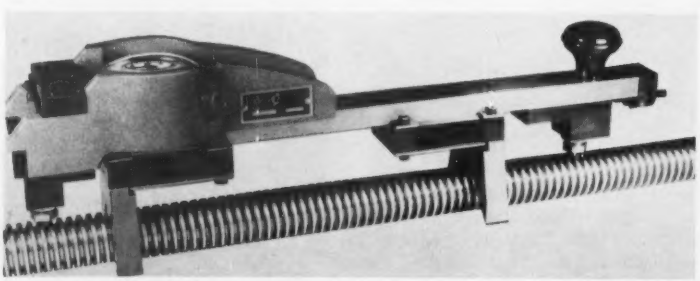
Fig. 2. Starrett automatic centering punch of lightweight design

The Starrett "Redstripe" SM special alloy high-speed steel power and hand blades combine new developments in heat-treating and special high-speed steel.

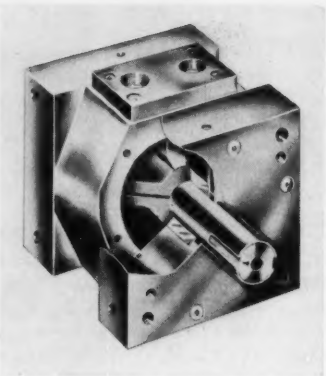
The "Greenstripe Safeflex" welded-edge power blades and hard-edge, flexible-back hand blades are yellow with a distinctive green stripe.

The Starrett "Bluestripe" selected high-speed steel power and hand blades are specially heat-treated for high-speed production sawing of hard-to-cut metals. Booth 1116.

Circle Item 175 on postcard, page 255



Jerpbak-Bayless lead-testing comparator



Roto-Mation torque motor

Oscillating Torque Motor

An oscillating torque motor that can be used on machine tools and a broad range of industrial equipment will be exhibited for the first time by Roto-Mation, Inc., Greenville, Ohio. This hydraulic-pneumatic device is designed to provide a simple, powerful, and versatile torque motor capable of transmitting a rotational movement of 280 degrees for turning, opening, closing, clamping, indexing, feeding, pushing or moving any type of load or mechanism. It operates on air, oil, or fire-resistant fluids at efficiencies ranging from 95 to 98 per cent and withstands heat up to 650 degrees. Booth 724.

Circle Item 176 on postcard, page 255

Lead-Testing Comparator

Jerpbak-Bayless Co., Solon, Ohio, will exhibit a portable lead-testing comparator designed for fast, accurate inspection of lead-screws while on or off a machine. Once set to conform to the measurements of a master or precision screw, the new comparator may be used to check screws after heat-treating, during the finishing operation, or at any time that the screw is in process on the machine. The gage also checks the amount of wear on machine tool lead-screws without removing them from the machine.

The standard lead-testing instrument is 12 inches long and has a capacity for measuring threads from 7/8 inch to 2 1/2 inches in diameter in any pitch. The sturdy, lightweight gage is easily held to the work and inspection results are registered on a dial. Booth 1031.

Circle Item 177 on postcard, page 255

Automatic Press Line for England

Shortage of labor is acute not only in this country, but also abroad. Great Britain, in its post-war boom, has felt the labor shortage in all phases of industry. In England, as in the United States, this boom has resulted in an increasing demand for automobiles

THE Dunlop Rim & Wheel Co. of Coventry, England, Division of Dunlop Rubber Co., has been faced with a growing demand for automobile wheels. Existing plant facilities have been pushed to near-maximum capacity in an effort to keep abreast of the mounting influx of orders from automobile manufacturers.

An appraisal of plant facilities in the light of future requirements made several problems apparent. First, it was necessary to provide a means of increasing the production of automobile wheels far beyond the present rate by a method that would be affected little, if at all, by periods of labor shortage. Second, the press equipment must be flexible enough to accommodate inevitable alterations in product design. Finally, the press line must be designed to permit the addition of more units to allow a variation in the order of operation. Facilities for either the automatic production of large runs or hand-loading for small job lots were required.

Engineers of the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., designed a press line, believed to be the first of its kind in England, to meet these problems of flexibility. The line is composed of four individual presses as shown in the heading illustration, each machine being equipped with a feeding mechanism that integrates the group into an automated unit. Whenever necessary, however, the presses can be run independently without using the feed. The line can also be taken apart and then put together in different combinations, or even used singly as the situation demands. Eight sets of dies have been constructed by Huckins Tool & Die, Inc., South Bend, Ind., for use in these presses.

All the presses are one-point, single-action machines having eccentric-gear drive and plunger guiding. The lead press has a capacity of 275 tons and each of the remaining three units is of 600-ton capacity. Overload devices are installed on the three larger machines. These units prevent overload from occurring in the bottom 1/2 inch of stroke by placing a cushion of hydraulic fluid under the slide-adjustment nut.

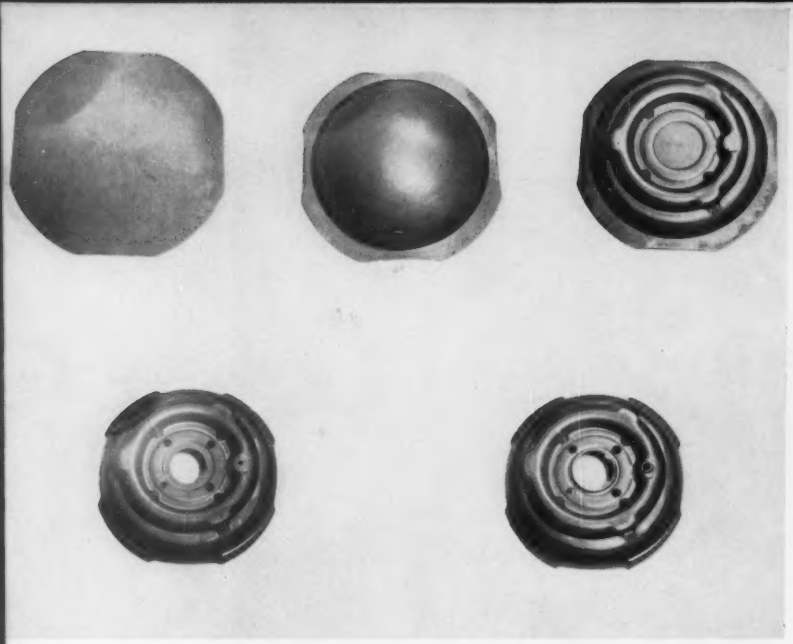


Fig. 1. Five production stages of an automobile wheel on the press line shown in the heading illustration. Shown are the blank as supplied to the presses, after cupping, reverse-forming, edge-cupping and piercing, and hole-sizing and under-cutting.

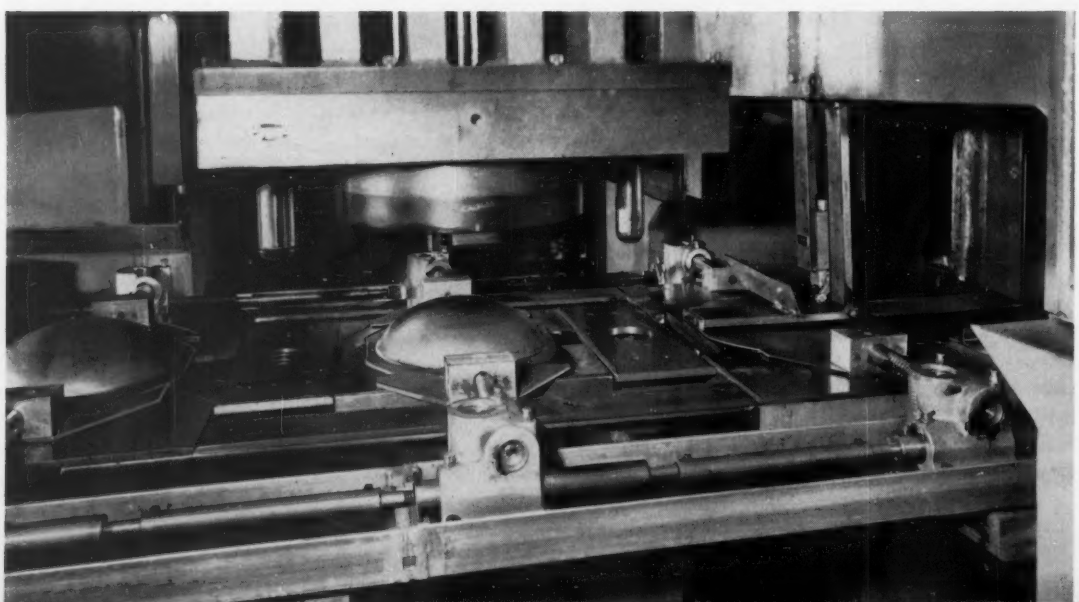
In Fig. 1 can be seen the five stages in producing one section of an automobile wheel. As the first step in the sequence of operations, blanks are loaded into a stack-feeding unit at Station 1. The unit is designed to permit reloading without interrupting the automatic operation of the line. Special steel baskets are provided which hold an eight-minute supply of blanks (about 100 pieces). The baskets are bottomless, the blanks resting on cams that project from the sides.

While the line is in operation, a full basket is placed in position on a pneumatically elevated platform located directly above the feed stack. When the supply of blanks has been reduced to six pieces, a limit switch is tripped which causes the basket to be lowered onto the stack. The basket cams are pushed aside and the contents are deposited on top of the stack. The basket is then returned to the top, where it is replaced by a full one.

A push bar, operated by a hydraulic cylinder that is timed with the transfer feed mechanism, slides the bottom blank forward to a positive stop at Station 2. Enough clearance is provided to advance only one blank at a time from the hopper stack. Further protection is provided at this station by a switch unit that tests for blank thickness. Should a double blank be encountered, the switch will shut down the entire line.

From this point a transfer feed mechanism grips the blank and advances it to Station 3. The actual feed is accomplished by a series of fingers that move inward from both the front and rear to clamp the piece parts and advance them to the

Fig. 2. Cupping blank in the first press, Station 3. At the previous station (right) can be seen the position stop-arm and the double-blank limit switch.



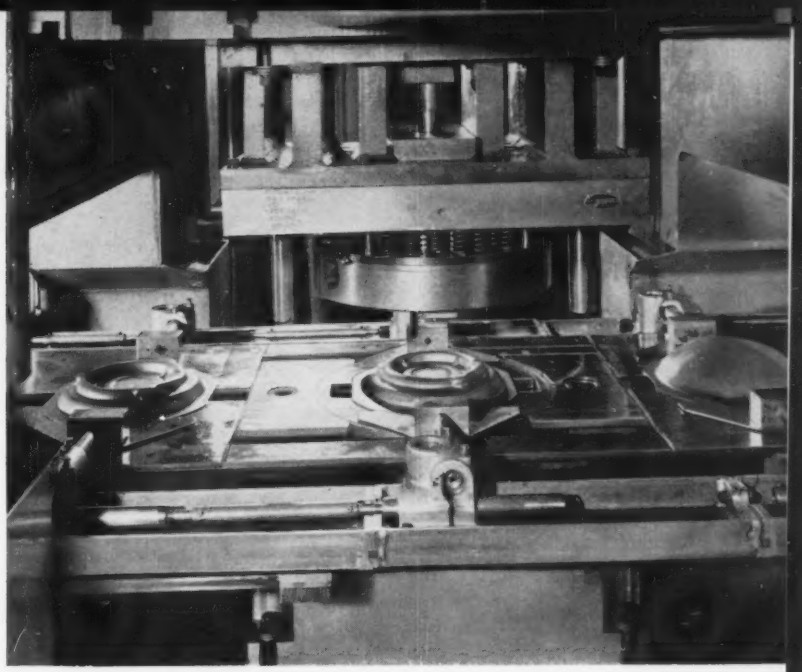


Fig. 3. In the second press, Station 8, a reverse-forming operation is performed. This step requires a force of approximately 500 tons. The additional tonnage provided on this and the following presses is in the interest of versatility.

next station, 24 inches to the left. They then move outward to release the work, and return to their starting positions. Through most of the travel the piece parts are slid along a runway that is flush with the lower die surfaces. The only place at which the parts are lifted from the runway is at a flip-over station.

There are seventeen sets of transfer fingers which, together with the stack-feed push-rod, move the piece parts through nineteen stations in the line. All of the transfer fingers function as a single unit, although they actually consist of three individual transfer devices that are hydraulically and mechanically locked together. This provides a high degree of flexibility to handle future manufacturing problems.

Each of the 600-ton capacity presses has been equipped with a separate hydraulic power unit, and has feed bars constructed to a standard design so that it is possible to add another press to the line and tie in an additional standard feedbar. Although the equipment functions as an automatic four-press transfer feed line, the controls of each unit are wired to permit individual operation.

After the transfer fingers have positioned the piece part at the third station and then retracted, a cupping operation is performed, Fig. 2. This operation requires the full 275-ton capacity of the first press. Stations 4, 5, 6, and 7 are idle.

The eighth station is located in the second press. Here a reverse-forming operation takes place as shown in Fig. 3. A force of 500 tons is required for this step. Stations 9, 11, and 12

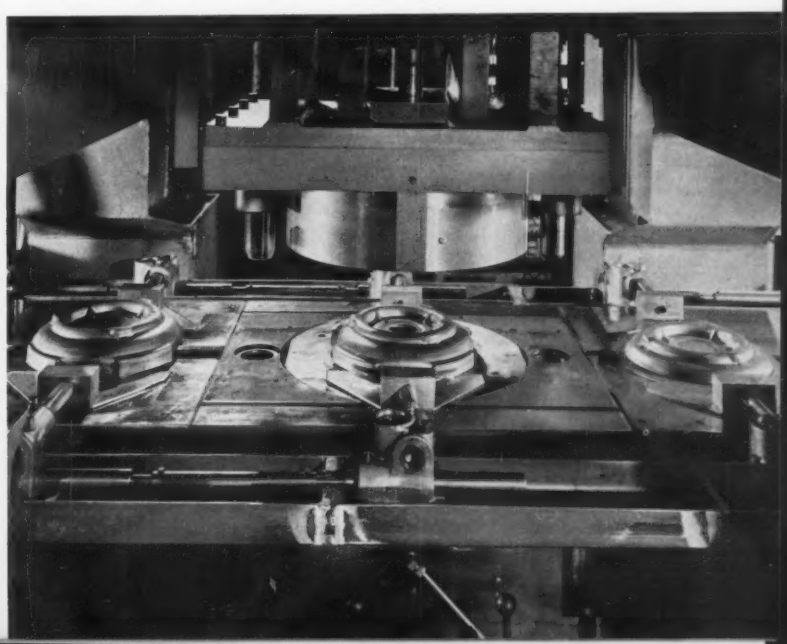


Fig. 4. The edges of the stamping are cupped and the bore and bolt holes are pierced at Station 13. A force of about 300 tons is required in this third press.

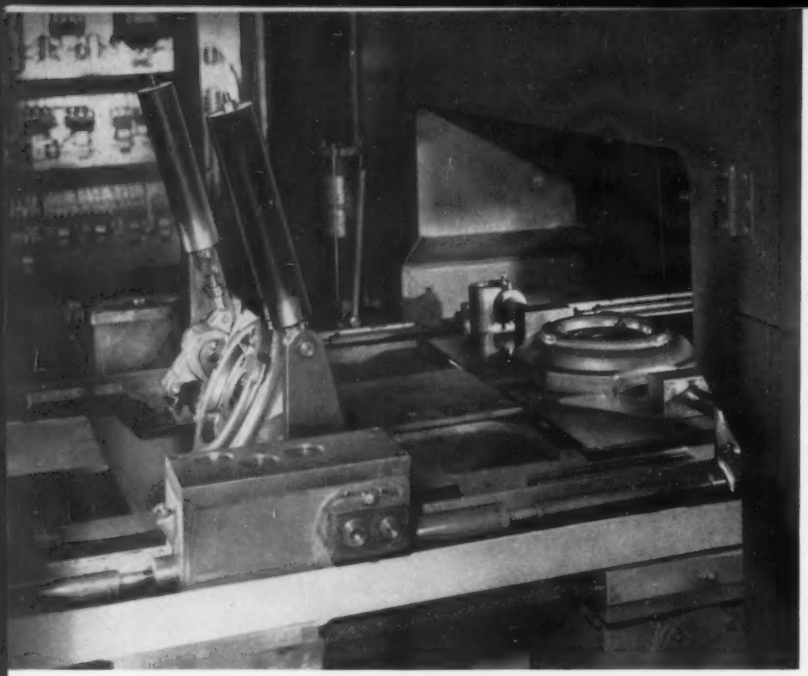


Fig. 5. A flip-over mechanism is shown as it begins to invert a stamping. The device has left Station 15 and is advancing toward Station 16. A gap in the runway trips the spring-loaded fingers.

are idle, with Station 10 being equipped with a flip-over device for future use.

At Station 13, Fig. 4, a combination edge-cupping and piercing operation is performed. A force of 300 tons, or one-half the capacity of the third press, is necessary. The fourteenth station is an idle position.

A flip-over device at Station 15 inverts the stamping as can be seen in Fig. 5. The unit is simply a pair of heavy fingers that are normally held in a vertical position by springs. When lined up at the fifteenth station, however, the fingers are tripped and forced to lie flat along the runways. In this horizontal position the fingers grip the stamping and advance toward Station 16. Halfway between the two stations there is a gap in the runway that permits the spring-loaded fingers to return to their normal vertical position. As the fingers advance past the gap they are once again tripped and forced to pivot in the opposite direction. This results in a 180-degree turn-over of the stamping. On the return travel of the feeding mechanism the fingers are swung back to their original position at Station 15.

Stations 16 and 17 are idle. At the eighteenth station, which is in the fourth press, hole-sizing and under-cutting operations are accomplished under a force of 300 tons. This can be seen in Fig. 6.

At Station 19 the finished stamping is dropped into an unloading chute. This particular part started off as a 14- by 14-inch shaped blank of 0.116-inch thick steel and ended up as a finished part 12 1/4 inches in diameter.

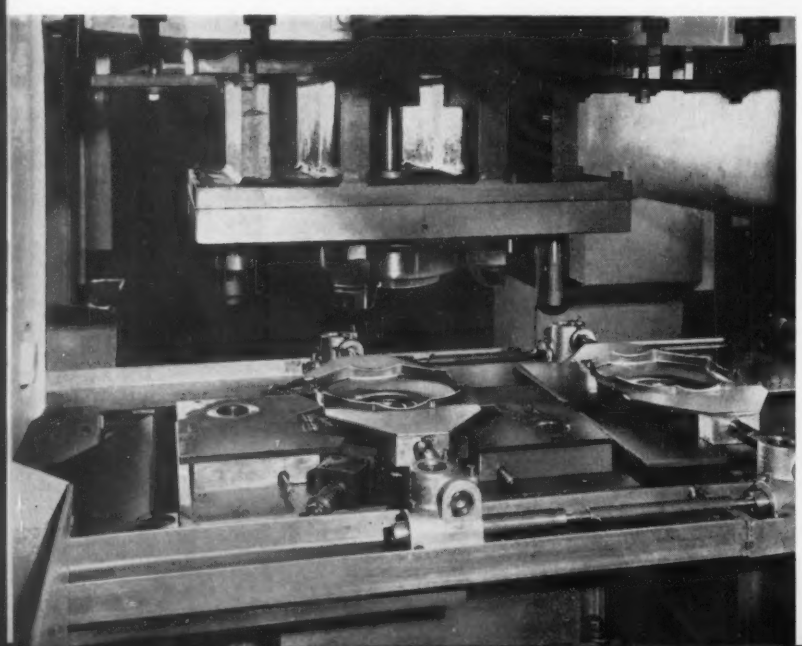
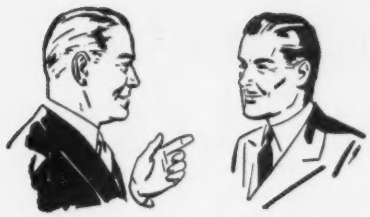


Fig. 6. Holes are sized and the bosses are under-cut with the stamping in an inverted position at Station 18. The unloading chute, which is at Station 19, can be seen at the left in this fourth press.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Sales Control Versus Sales Leadership

EVERY week end I have to make out elaborate reports for the sales manager. These reports do not give me the opportunity of expressing the thoughts that are uppermost in my mind."

"What I need, above all else, is a chance to talk over my problems with someone who understands them. Just explaining my difficulties would help."

These statements were made by sales engineers present in a group meeting, who were asked for opinions on sales supervision and control. One questioned control through system—the other, lack of leadership because of inadequate personal contact.

Every sales manager should repeatedly evaluate his own supervisory methods. It is within his power to help develop the individual sales engineer as well as the team. He must dig deeply into individual personalities in the light of each salesman's environment.

What does the top-notch sales engineer want beyond dollar pay? Here are some of the things:

Orderly methods of sales procedure at headquarters and in the field;
Freedom from unnecessary clerical work;
Intelligent and focussed help when needed;
Opportunity to discuss with his manager, problems relating to his work;
An attentive ear to consider all sorts of suggestions;
Appreciation and recognition;
A sense of company membership.

Let us elaborate on each line of thought.

Sales engineers acclaim orderly procedure on the part of the home office. But, on their own part, this is often neglected. For instance, the sales manager must insist that inquiries are clear and complete. Likewise equipment orders. It is his job to require systematic procedure and show each salesman how it benefits him with his customer.

Most sales engineers abhor detailed clerical work that absorbs selling time. Some sales departments are hamstrung with record keeping—records often unused. Most successful sales managers reduce records to an essential minimum and inform each salesman of their purpose and use.

When it comes to help in actually selling any prospect, the successful sales manager is wary of stepping in and assuming a responsible part. But he readily makes suggestions. How can any salesman grow without experience in solving difficult problems? Often he needs expert engineering advice.

The successful sales engineer is sensitive to human action and reaction. All business transactions are subject to emotional influence. Ample opportunity should exist for personal contact and discussion between the sales supervisor and the sales engineer. Friendly discussion often wipes out doubt and provides inspiration.

Most sales engineers enjoy the chance to make suggestions that might affect policy and plans. If not adopted, they like to know why.

Few human beings work for money alone. Personal recognition, appreciation, and applause do not pay bills, but do yield satisfaction and rally enthusiasm.

Though all of us demand treatment as individuals, we also desire a sense of belonging. Our status is enhanced if we belong to a high-class team intent on progress and victory.

One sales manager recently told me that his job was to get down to the level of the sales engineer. I agree, except for the word "down." My experience has been that we must often "get up" to the level of the sales engineer. Sometimes he has a more reasonable philosophy and can make constructive business suggestions.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

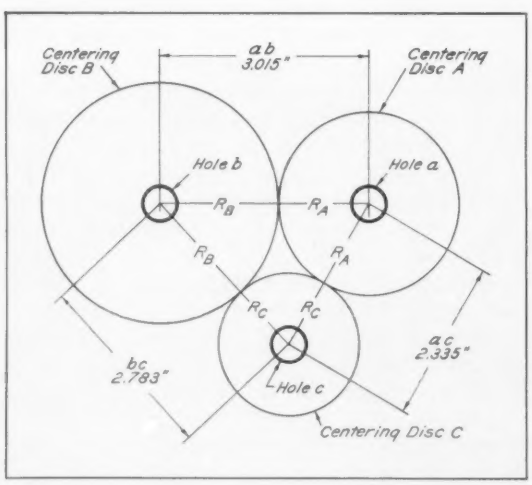
Edited by HENRY H. RYFFEL

Accurate Location of Three Holes by the Disc Method

By JAY N. EDMONDSON, Professor, Industrial Engineering, Ohio State University

A problem common to both machine lay-out and jig and fixture work involves machining three holes accurately to specified center-to-center distances. If a jig borer is not available, some other means, such as the use of centering discs, must be employed to obtain the desired accuracy. In this method, three discs with outside diameters A, B, and C are so made that when their peripheries are in contact each disc center will coincide with the center of the hole to be machined, as shown in the accompanying diagram. Holes a, b, and c are then drilled in the work-piece using centered holes in discs A, B, and C as a means of transfer.

If a high degree of accuracy is required, the work, with the discs clamped in place, is mounted on the faceplate of a lathe. The hole in one of the discs is then centered on the lathe spindle by using an indicator, and the hole in the work is produced by drilling and boring. This process is repeated for each of the other holes. The diameters of the discs required for this set-up are calculated from three simple equations.



Holes (a), (b), and (c) are to be machined so that their center-to-center distances (ab), (bc), and (ac) will be 3.015, 2.783, and 2.335 inches, respectively.

Solution:

Referring to the diagram, it will be seen that

1. $R_A + R_C = 2.335$
2. $R_A + R_B = 3.015$
3. $R_B + R_C = 2.783$

Next, subtract Equation (3) from Equation (2):

$$(R_A + R_B) - (R_B + R_C) = 3.015 - 2.783$$

so that

4. $$R_A - R_C = 0.232$$

Next, add Equation (1) to Equation (4):

$$(R_A + R_C) + (R_A - R_C) = 2.335 + 0.232$$
$$2R_A = 2.567$$

5. $$R_A = 1.2835$$

The radius R_C is found by substituting the value of R_A from Equation (5) in Equation (1):

$$1.2835 + R_C = 2.335$$

6. $$R_C = 1.0515$$

In the same way, R_B is found from Equation (2):

$$1.2835 + R_B = 3.015$$
$$R_B = 1.7315$$

The diameters of the discs A, B, and C are then computed:

$A = 2R_A = 2 \times 1.2835 = 2.567$ inches
$B = 2R_B = 2 \times 1.7315 = 3.463$ inches
$C = 2R_C = 2 \times 1.0515 = 2.103$ inches

The results of this problem are summarized in the following simple formulas for use in similar problems:

Diameter $A = ab + ac - bc$

Diameter $B = ab + bc - ac$

Diameter $C = ac + bc - ab$

In these formulas, A, B, and C are the diameters of the discs, and ab, ac, and bc are the center-to-center distances shown in the diagram.

Yardsticks for Industry Shrink to a Millionth of an Inch

CERTIFIED precision standards for dimensional control to an accuracy of 1/1,000,000 inch are now available to industry from the new Eli Whitney Metrology Laboratory of the Sheffield Corporation, Dayton, Ohio. Formally dedicated this February, the Laboratory supplements the work of the Metrology Division of the National Bureau of Standards. It uses the same supreme length standard and the same skills, equipment, environment, and procedures as the Bureau of Standards.

By naming the new facility for Eli Whitney, Sheffield honors the father of mass production. Although more widely remembered as the inventor of the cotton gin, Whitney's great contribution to posterity came by demonstrating he could make muskets with parts that were completely interchangeable. For the first time, workers possessing unit skills replaced the artisans of the handicraft system, who fashioned an object from start to finish. Mass production came alive, and manufacturing controls—standards, gages, and measuring instruments for adequate dimensional control—were essential to interchangeability.

The Laboratory represents an investment of $250,000,000. It is situated within the Sheffield plant, yet physically divorced from it. The floor, 28 by 30 feet, is carried on its own footings, and consists of a thick concrete slab, covered by 4 inches of cork insulation. Superimposed on this is a second concrete slab covered by plastic tile. Thus, vibrations from within the plant or outside cannot be transmitted. Walls are 8 inches thick and insulated. Likewise, the ceiling is insulated on its underside, and supports a perforated subceiling which serves as a 36-inch plenum chamber for mixing and tempering the air.

All incoming air is filtered by electrostatic precipitation, and heated or cooled as needed to control humidity and temperature. Discharge vents are at floor level. A complete air change is effected every five minutes. Anyone entering the Laboratory must pass through an air lock. Temperature is held at 68 degrees F. within one-twentieth of a degree, and relative humidity is held to a maximum of 50 per cent.

The master instrument for light-wave comparison measurement is a Zeiss Koesters absolute interferometer. (See article, page 190.) Other instruments include a Zeiss Opton interferometer, Opton interference microscope, Taylor-Hobson "Talyrond" and "Talysurf," Tukon and Wilson hardness testers, and an auto-collimator, as well as a number of instruments of Sheffield's own manufacture. The interferometers are housed in a smaller room within the Laboratory, having separate temperature controls.

Services available include the calibration of gage-blocks, plain or taper plug and ring gages, master setting gages and surface plate flatness; measurement of parts contour, thread and gear wires, and fiber fineness; surface-finish analysis; and hardness testing. Also offered are consulting services for establishing industrial metrology facilities, training in measuring techniques, and product dimensional audit services.

LATEST DEVELOPMENTS IN *Shop*

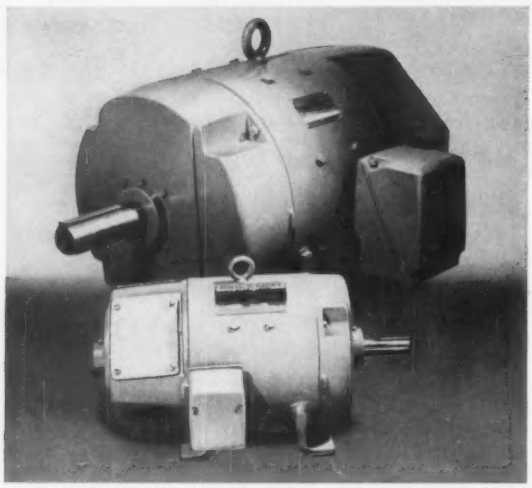


Fig. 1. G. E. "Kinamatic" direct-current motor of 50-H.P. rating is seen at top, and 3-H.P. motor at bottom.

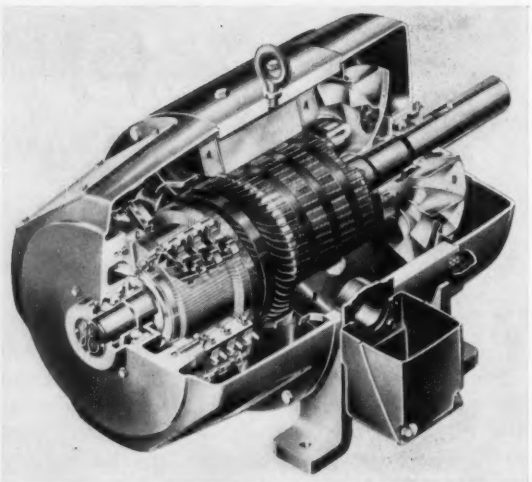


Fig. 2. Cut-away view of "Kinamatic" motor shows brush rigging, large fan, and other features.

General Electric Direct-Current Motors and Generators

A complete line of direct-current motors, Fig. 1, and generators has been announced by the General Electric Co., Schenectady, N. Y., to meet modern industrial needs for faster, more continuous, and more automatic production. This "Kinamatic" line has been designed for versatility of application and performance, and is built to the latest NEMA suggested standards for future design. Speed is adjustable by armature voltage control, field strength control, or any combination of both. High base speeds are available, and higher top speeds may be obtained for constant horsepower applications by field strength adjustment. The motors can also operate at lower speeds, including stalled torque, when properly applied.

All standard motors and generators in the line have dripproof enclosures and are supplied with a guaranteed 15 per cent service factor. Class B insulation is supplied throughout, and a high-volume fan provides improved air flow. Low armature inertia permits fast speed of response. Ease of maintenance and smooth, streamlined design are additional features. All motor ratings from 1 to 150 H.P. at 1750 R.P.M. and all generator ratings from 3/4 to 100 K.W. are available. An average of 33 per cent increase in horsepower per pound has been achieved.

Peak commutation has been built into the motors for quick acceleration and deceleration. Fewer turns per armature coil insure minimum inductive kick when stored energy is released from the coil. A full complement of commutating poles permits greater overload without magnetic saturation. To provide stability over the entire speed range without stabilizing windings, these motors have been designed with unusually large air gaps and special pole face shapes to reduce armature reaction effect that tends to cause speed instability.

To facilitate maintenance, large hand holes are provided for the brushes, as seen in Fig. 2. Brush springs may be quickly disengaged with one hand, the springs hanging captive to the brush-holders but clear of the brushes for easy replacement. Brass brush-holders and molded polyester glass yokes provide a rugged, corrosion-resistant assembly. Ball bearings are packed with a special lubricant which will last many years under normal operating conditions. Conduit boxes of three different sizes are available on each frame and can be easily relocated from one side of the frame to the other.

Circle Item 178 on postcard, page 255

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Shaving Machine for Producing Thin-Tooth Sections in Flanks of Spur-Gear Teeth

A unique high-speed process for producing thin-tooth sections in the flanks of spur-gear teeth has been developed by the National Broach & Machine Co., Detroit, Mich. This patented process, carried out on the Model PSA-4-inch Red Ring planetary gear shaving machine shown in Fig. 1., was developed to meet the needs of transmission builders. The machine is designed for high-speed production of thin-tooth sections having uniformity; accuracy of form, depth, width, and concentricity; a high-quality surface finish; and a sharp step at the edges of the section as shown at *X*, Fig. 3. When a thin-tooth section of this type is provided in a transmission clutch gear, all tendencies of the gear to slip out of mesh are avoided.

A variety of sections with edge shapes such as shown in Fig. 3 can be produced to suit the requirements of various transmissions. The thin-tooth section can be produced in either one or both sides of all of the spur-gear teeth. The profile of the section produced by the shaving closely approximates an involute form and is usually well within required tenths of a thousandth involute profile tolerances.

The planetary shaving machine has a hardened and ground high-speed steel cutter that resembles an internal spline. A gear, whose teeth are to be thinned in a given flank section, is mounted in a three-jaw gear-tooth chuck in mesh with the cutter. The work-gear rotates around the cutter center line during the shaving process. Thus, the gear is rotated about an axis in mesh with the cutter during the shaving operation in much the same manner that a planet gear runs with an internal gear.

Fig. 1. Red Ring planetary gear shaving machine that produces thin-tooth sections in flanks of spur gears

Fig. 2. Unloading a finish-shaved truck transmission clutch-gear from machine shown in Fig. 1

Since the cutter has single cutting edges, which alternately thin first one side of all the teeth and then the other, a timed relationship is maintained between the gear and the cutter. This is achieved by locating the gear radially in the toothed chuck jaws and rotating the chuck about the cutter center line with a master gear and internal gear assembly located in back of the cutter. If desired, the gear can be mounted on a work spindle and located radially.

At the loading position, the gear is located so that it is in a backlash position with respect to each cutting edge of the planetary shaving cutter. When the automatic cutting cycle is initiated, the gear axis is rotated about the cutter center line, and the cutter is fed tangentially in increments, first in one direction, next back to backlash position, then in the opposite direction, and finally back to backlash position for unloading.

The twenty-five-tooth, seven-pitch, 20-degree pressure angle gear being loaded into the planetary shaving machine, Fig. 2, has an outside diameter of 3 3/4 inches and a width of 1 9/16 inches. This truck transmission spur-tooth clutch-gear has a 3/8-inch wide, 0.010 inch deep section with a sharp step produced in each tooth flank by the shaving process.

Circle Item 179 on postcard, page 255

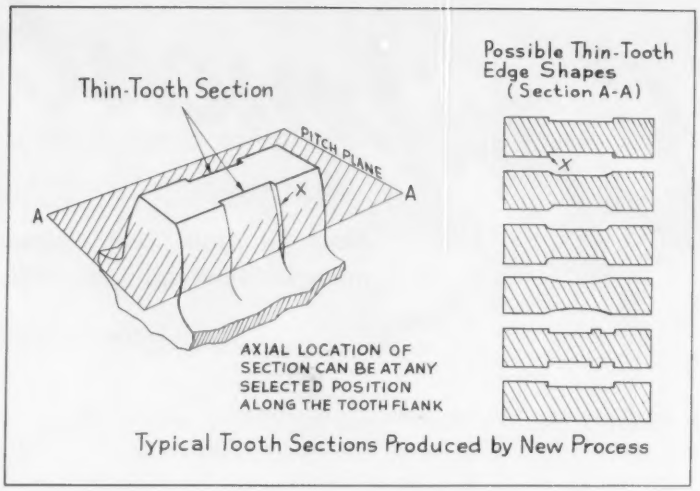


Fig. 3. Diagrams illustrating gear tooth thinning process

Norton "Swivalign" Indicator

To provide accurate control for grinding close tolerance tapers, the Norton Co., Worcester, Mass., has developed a "Swivalign" dual electric indicator for measuring swivel table adjustment. This device—applicable to Norton cylindrical and universal grinding machines—simplifies the adjustment of swivel tables to correct errors in grinding exact tapers or to eliminate taper in straight work.

Norton Type V-4 universal grinding machine with "Swivalign" dual electric indicator set-up

It consists of one electrical pick-up unit with zero adjusting knob at each end of the swivel table and a two-channel amplifier having a pair of indicating meter elements reading on a common scale. Each meter needle responds to movements of only one of the pick-up elements.

Electrical connections of this indicator are so arranged that both needles rotate or move in the direction of the swiveling table. Thus, if the table is swiveled clockwise, as viewed from above, the needles rotate clockwise and vice versa.

Divisions on the meter scale indicate taper changes directly in 0.001 inch per foot of taper. Two ranges of readings—one for extremely accurate settings with graduations of 0.0001 inch per foot and the other, 0.0005 inch per foot of taper change—are provided. The desired range is obtained by a selector switch on the front of the instrument case. A conversion chart on the side of the instrument case gives taper-foot values for corresponding micrometer reading of work diameters.

Circle Item 180 on postcard, page 255

Green-Yellow Slide Rule Developed to Save Eyes

Light-alloy slide rules, made in a green-yellow shade to eliminate violet and red rays which focus in front of and behind the retina, are a newly developed product of Pickett & Eckel, Inc., Alhambra, Calif. The green-yellow shade, coinciding with the optimum sight point of

the spectrum, cuts eyestrain, blurring, and errors in reading calibrations.

Non-corrosive, non-rusting metal construction eliminates warping, swelling, and binding. Available in 6- and 10-inch Trig, Log-Log standard rules, or in rules made to special order.

Circle Item 181 on postcard, page 255

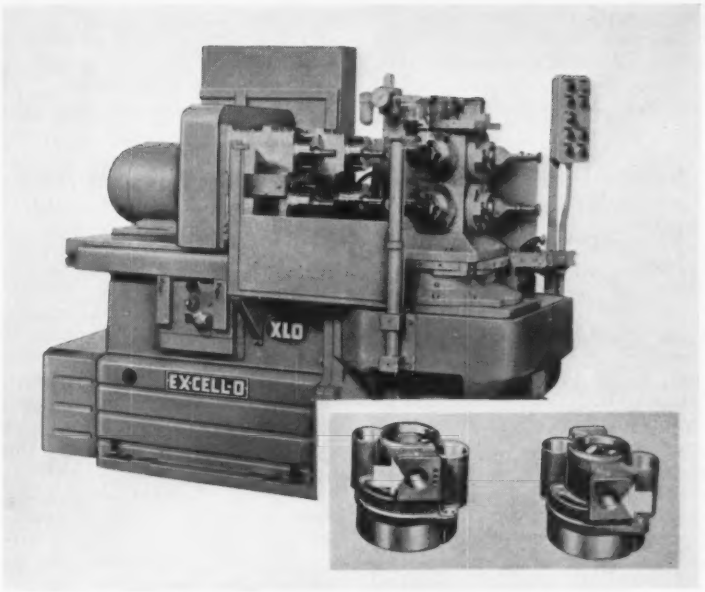
Cabinet Stand for Schaublin Lathes

Carl Hirschmann Co., Inc., Manhasset, N. Y., has announced that a cabinet stand is now available for the Schaublin lathe. This SV 102-80 stand is said to greatly increase operating efficiency. The pedestal is a one-piece casting made to withstand vibration and insure positive stability at very high speed. Each pedestal is made to accommodate a series of standard units which make the lathe a multiple-purpose tool.

Among the many accessories available are: clutch unit and brake; geared speed reducer; belt-shift control; grinding and milling drive; variable speed drive; parts drawers; knee control; coolant system; foot rest; and chair.

Circle Item 182 on postcard, page 255

Schaublin lathe equipped with cabinet stand placed on the market by Carl Hirschmann Co.



Ex-Cell-O one-way machine with four-station fixture

Ex-Cell-O Machine Equipped to Process Refrigerator Parts

The Ex-Cell-O Corporation, Detroit, Mich., has equipped its Style 54 one-way machine for processing cast-iron compressor crankcases. The four-station indexing fixture shown in the set-up illustrated is used to bore, counterbore, and chamfer two offset, opposing cylinders, holding the machine work within accurate dimensional limits. Comparable accuracy is also achieved in maintaining the cylinder bores in their correct positions with respect to the main crankcase bearing.

The two crankcases are loaded one above the other at each of the four indexing stations. Loading is done at the right of the indexing fixture, while other parts are being machined at the front and rear stations. The parts are air-clamped in position. A mechanical safety device is provided to retain the parts on the fixture, should the air pressure fail.

A motor-driven mechanism turns the fixture and a wedge type shot bolt positions the fixture radially. During the machining operations, the fixture is held down by hydraulic pressure to insure a firm bearing. This pressure is automatically released for the indexing movements. Until the bearing is established, a safety switch prevents the tool spindles from approaching the work-piece.

The cycles are fully automatic except for loading and unloading. The unit can easily be rearranged for entirely different production runs by changing fixtures and tooling. When assembled as two-,

three- and four-way machines, the units can be electrically interlocked for simultaneous operation, or for operation in any desired sequence. All units can then be controlled from a single push-button station. Built-in safety devices prevent machine operation until clamping is completed.

Circle Item 183 on postcard, page 255

Colonial Dual-Ram Connecting-Rod Broaching Machine Equipped with Automatic Tilt-Up Fixtures

Automatically actuated tilt-up fixtures are used to speed up the broaching of connecting-rod half rounds and mating faces on a 15-ton, 66-inch stroke dual-ram broaching machine designed and built by the Colonial Broach & Machine Co., Detroit, Mich. This set-up enables a major automobile manufacturer to produce 550 pieces per hour on a single machine, and 27,000 pieces are produced per broach sharpening. Duplicate fixtures are designed for safe, easy loading.

During the loading operation, the machine table is in the rear position with the fixture tilted upward approximately 45 degrees toward the operator. The operator drops two connecting-rod forgings into the fixture. No positioning is required because the tilt of the fixture allows parts to slide under the locators. The broaching cycle is started by depressing overhead palm-buttons which close the clamps and start the forward movement. As table and fixture move in, a roller bearing in a cam-track tilts the fixture into the cutting position. Interlocked controls then actuate the ram for the cutting stroke.

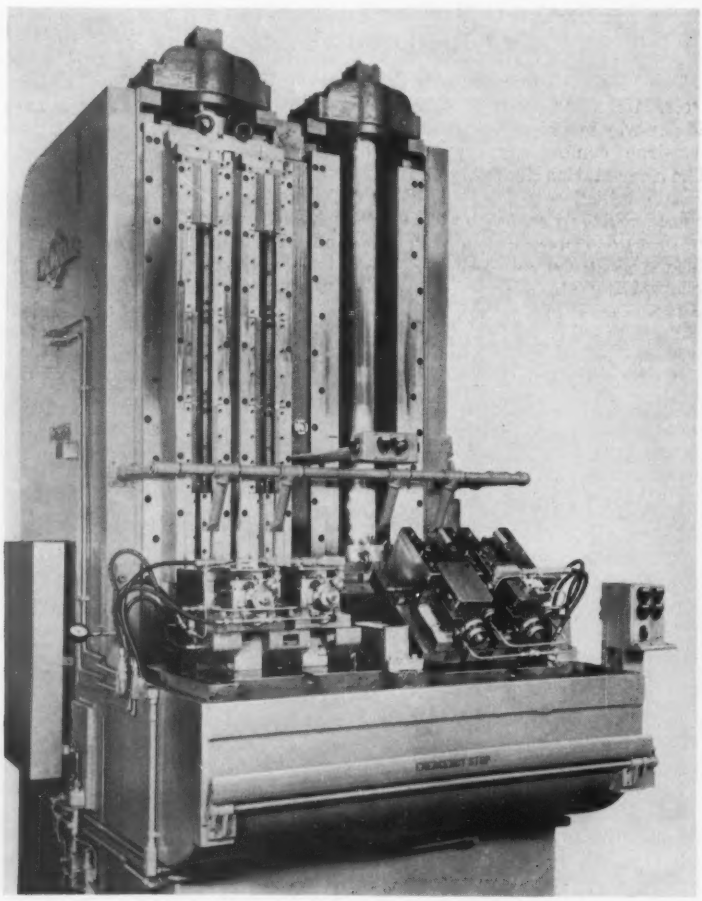


Fig. 1. Colonial broaching machine equipped with automatically actuated tilt-up fixtures

At the end of the cutting stroke, the cycle is reversed. The machine table moves outward, tilting the fixture into the unloading position. Each fixture holds two parts, and two fixtures are used, enabling four connecting-rods to be broached in one complete machine cycle. One fixture on the dual-ram machine is in the cutting position while the other is being unloaded.

Of particular interest are the trunnion type fixtures built in two separate components. The fixture base and tilting trunnion plate, containing locators, hydraulic clamps, and spring ejectors, are mounted on the broaching machine table. The tilting mechanism consists of a roller bearing on the trunnion plate engaged in a cam-track. A cam-track block is mounted on the bed of the broaching machine. Tilting plate and fixture base are held in positive alignment by four hardened V-locators which compensate for clearance required at the pivot pin.

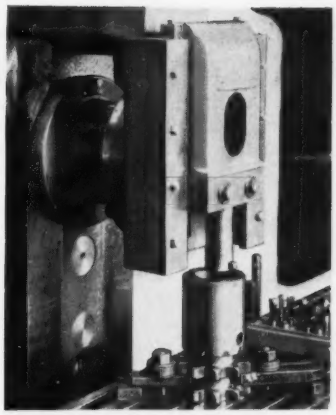
Fig. 2. Connecting-rods broached by machine shown in Fig. 1

Circle Item 184 on postcard, page 255

Slotting Attachment for Greaves Milling Machine

Keyway cutting, slotting, and die or fixture work requiring slotting operations can be performed on a Greaves horizontal milling machine with a new slotting attachment announced by the Greaves Machine Tool Division, J. A. Fay & Egan Co., Cincinnati, Ohio. The attachment can be mounted on the column face of the Greaves horizontal mill and is driven from the machine spindle.

The heavy cast head of the attachment can be rotated and set at any angle within an arc of 180 degrees. It has a maximum stroke



Greaves slotting attachment

of 4 inches, obtained through an adjustable eccentric drive, and can be set for any cutting stroke between 0 and 4 inches. Features include graduated swivel for accurate setting of machining angle, 1 to 1 speed ratio with machine spindle, and provision for use of standard slotting tools with shanks 5/8 or 1 inch in diameter.

Circle Item 185 on postcard, page 255

Cincinnati All-Geared Head "Tray-Top" Gap-Bed Lathes

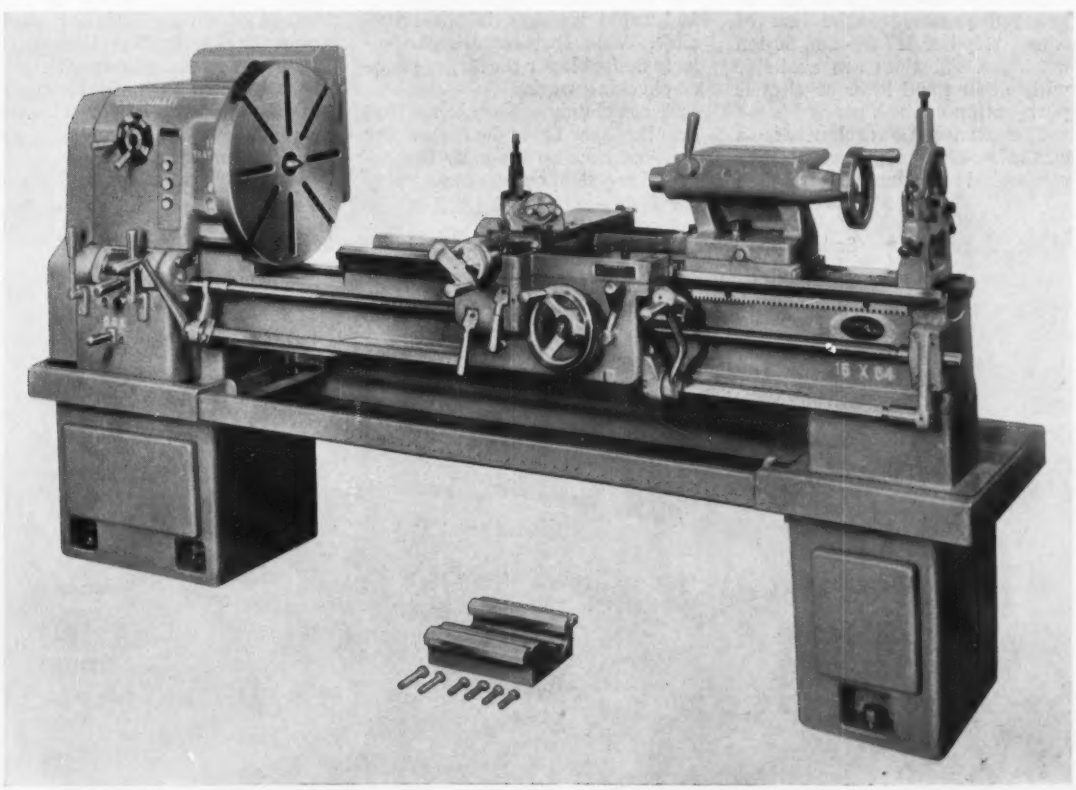
All-geared head, Model LE "Tray-Top" lathes with fixed-gap beds in 15-, 18-, 21 1/2-, and 26-inch sizes have been announced by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. These machines, designed for versatility in the metal-working industry, permit over-size work-pieces to be accommodated by removal of the gap block, which increases the swing sizes to 22, 27, 32, and 37 inches.

The lathes have twelve spindle speeds in geometric progression, with a three-lever, color-match, direct-reading shifting mechanism. The spindle, with long taper key drive nose, is rigidly mounted in three precision anti-friction bearings. All headstock bearings are pressure-lubricated with filtered oil. There are forty-eight thread and feed changes on the 15- and 18-inch lathes and fifty-four changes on the 21 1/2- and 26-inch lathes. These changes are obtained through an automatically lubricated quick-change gear-box.

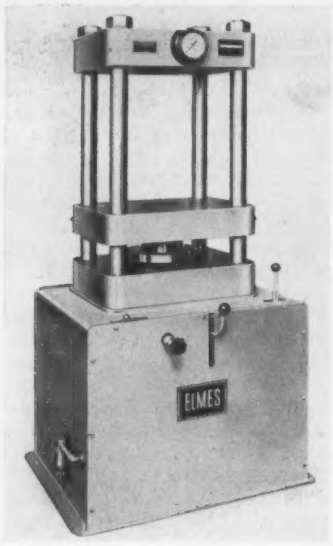
The apron is a one-piece, double-walled casting and is automatically lubricated. Longitudinal- and cross-feeds are engaged with drop levers which operate positive jaw clutches. A spindle start-stop control lever is supplied at the apron and quick-change gear-box. The bedways are ground and will be "Hardclad" flame-hardened if desired. Lubrication of the carriageways and cross-slide is provided by an oil shot system in the apron.

A fully enclosed electrical compartment provides a safe, accessible place for the electrical control equipment. A built-in disconnect switch prevents exposing a live panel. Power is transformed from 220 volts and over to provide 110 volts at the push-buttons. The 15- and 18-inch lathes are offered with a 3-H.P. motor, and the 21 1/2- and 26-inch lathes with a 5-H.P. motor mounted on the rear of the headstock leg. Recessed, precision type, built-in leveling jacks are provided on all sizes, and cabinet legs with easy-opening doors are furnished on the 15- and 18-inch sizes.

Circle Item 186 on postcard, page 255



All-geared "Tray-Top" lathe brought out by Cincinnati Lathe & Tool Co.



Elmes 75-ton "Hydrolair" press

Elmes "Hydrolair" Presses

American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio, has announced the addition of 75- and 100-ton air-powered presses to the line of Elmes "Hydrolair" 30- and 50-ton machines. All sizes are available with either hand lever or electric push-button control.

The Elmes "Hydrolair" is a small, low-cost press designed for economical production. It has neither motors nor pumps, its special hydraulic intensifier—the "Power-Petuator"—being actuated solely by compressed air. In most installations the press is operated by the regular shop air line. The "Power-Petuator" provides a continuous high-pressure stroke and maintains any pre-set pressure for as long as desired.

These presses are adaptable to many uses, including plastics molding, rubber molding, compacting, laminating, assembling, forming, gluing, and laboratory testing.

Circle Item 187 on postcard, page 255

Bardons & Oliver Saddle Type Lathe

Bardons & Oliver, Inc., Cleveland, Ohio, has announced a No. 21 saddle type turret lathe, redesigned to provide maximum versatility and to accommodate a wider range of work. It has a larger main drive motor of 20 H.P. that permits the use of heavier feeds up to the full capacity of the latest cutting tools. Higher spindle speeds up to 1000 R.P.M. provide for the machining of non-ferrous materials.

While the rigid bridge type cross-slide carriage is still optional, a full swing side carriage is now being offered. The full swing carriage has the advantages of an increased swing over the cross-slide, additional clearance for the hexagonal turret tooling, and rapid traverse to the cross-slide. These features are particularly desirable for the larger range of chucking work.

A completely self-contained hydraulic bar feed decreases the feed-out time by one-half. The hydraulic collet chuck has amply increased gripping force for the heavier drilling operations.

The No. 21B size machine has 3-inch round collet chuck capacity for standard-duty work. The No. 21C size machine has 4 1/2-inch round collet chuck capacity, for light-duty work. Both sizes provide either 15 1/2-inch swing over the cross-slide with full swing carriage, or 12 1/2-inch swing over the cross-slide with the bridge type carriage.

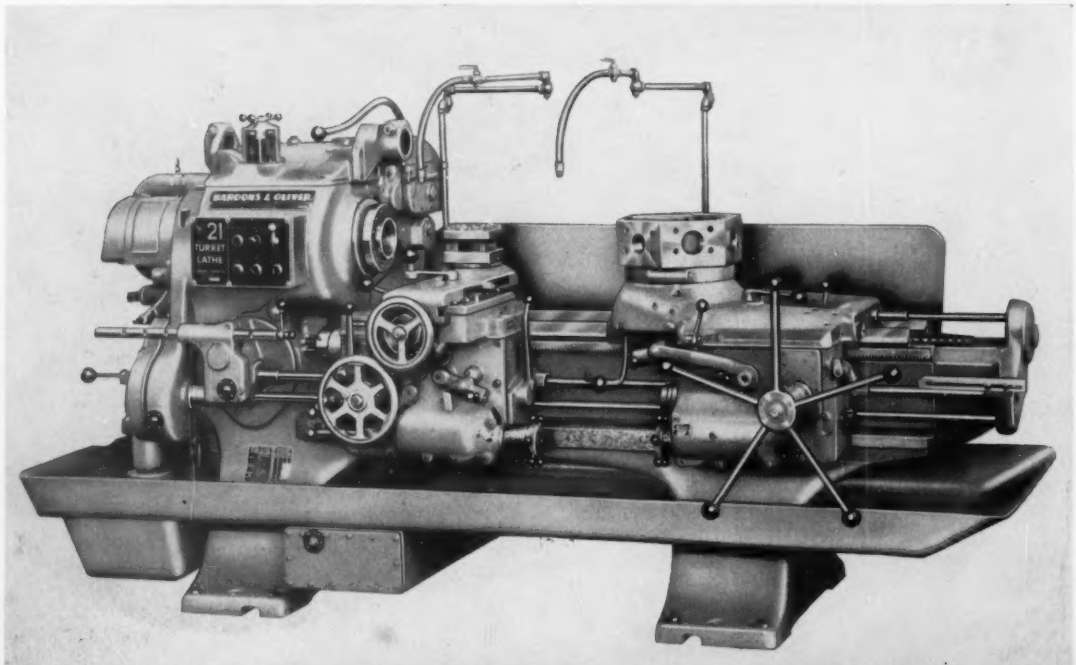
Circle Item 188 on postcard, page 255

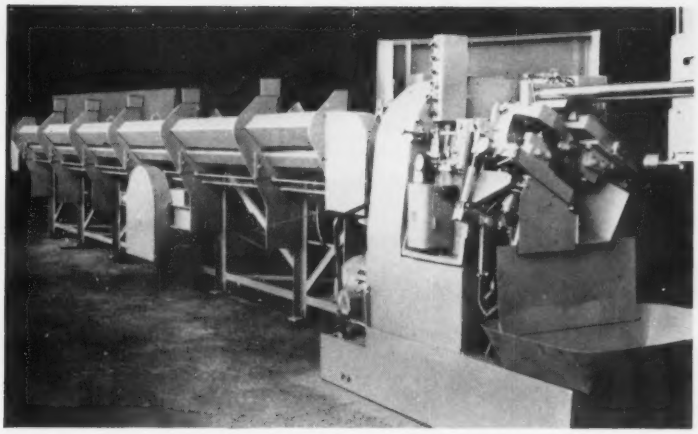
Automatic Bar Feeder

The Modern Machine Tool Co., Jackson, Mich., has brought out a bar feeder for its cutting-off machine, which will handle random lengths of tubing and bar stock automatically, feeding the entire stock load to the machine without any attention from the operator. Remnants of each bar or tube are automatically ejected and the end of each new bar trimmed.

The feeder has a hopper for use

Saddle type lathe of improved design announced by Bardons & Oliver





Cut-off machine with automatic bar feeder made by Modern Machine Tool Co.

with light-wall tubing which holds about 100 pieces having a diameter of 2 3/4 inches or other size of equal bulk. There is ample room for chain removal when crane loading is desired. Adjustment for different stock diameters is made by turning a crank until the desired diameter is indicated on a graduated scale. Feeders are available for maximum length bars, and in sizes to fit every model of the Modern cutting-off machine. Simplified feeders for a single diameter stock can be furnished.

Circle Item 189 on postcard, page 255

Bodine Dial Type Automatics

Automatic machines equipped with dial feeds, made by the Bodine Corporation, Bridgeport, Conn., are being used by wet cell battery manufacturers for work combining operations on both metals and hard rubber. The machines are Bodine 42-30 dial type automatics equipped with 12-station dial feeds. The work consists of finishing battery cell covers which have phenolic-molded bodies with lead terminal inserts. Each of the Bodine units requires only one attendant and combines operations which had previously required five separate machines and as many operators.

The operator hand-loads the rough covers into the dial nests—all other operations are completely automatic. At the first station flash is trimmed from the vent-hole and slots. At the second station the flash is removed from the outside edges of the cover and at the third and fourth stations terminal holes are reamed in the lead inserts at either end of the piece. Hollow milling is performed at the fifth and sixth stations to finish the terminal holes, and at the seventh station the finished cell covers are automatically ejected.

A cover is completed at each stroke of the machine, which delivers 25 strokes per minute. Production for a single machine is said to be 1250 pieces per fifty-minute hour. The machines are equipped with multiple tooling so that they can be used for various sized covers for both 6- and 12-volt batteries.

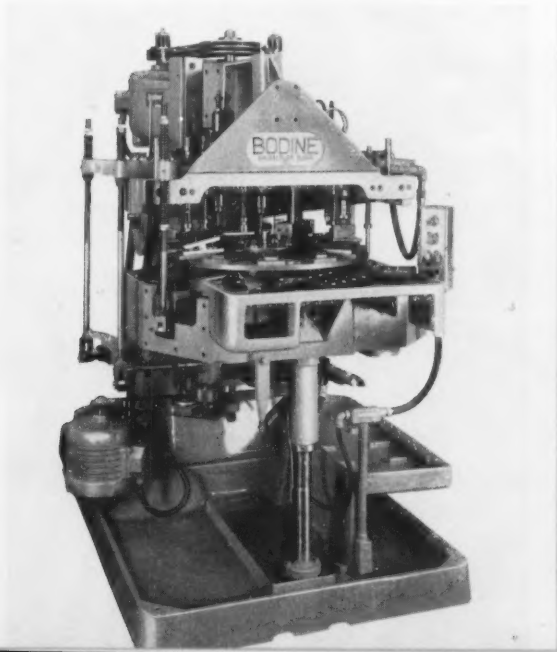
Circle Item 190 on postcard, page 255

Manley Air-Operated Press

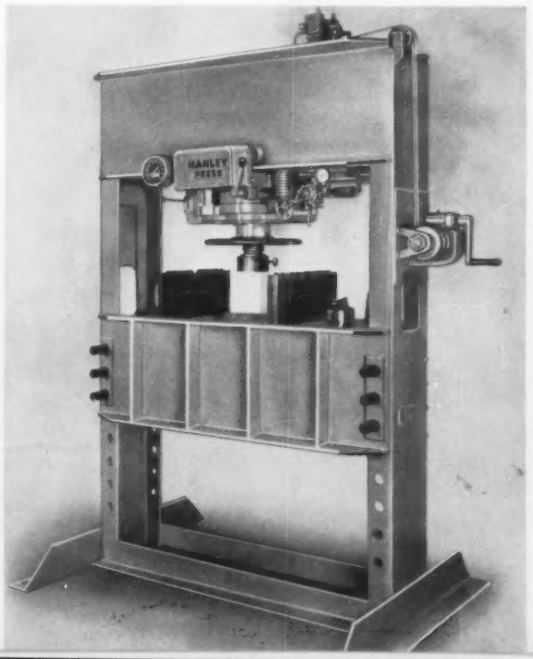
A Manley air-operated press similar in design and construction to the 60- and 80-ton models, built for pressures up to 150-tons, has been introduced by the Manley Division, American Chain & Cable Co., Inc., Bridgeport, Conn. Heavy-duty capacity and the ability to take rough treatment are features

(Continued on page 244)

Bodine machine equipped to process battery covers



Manley heavy-duty air-operated press



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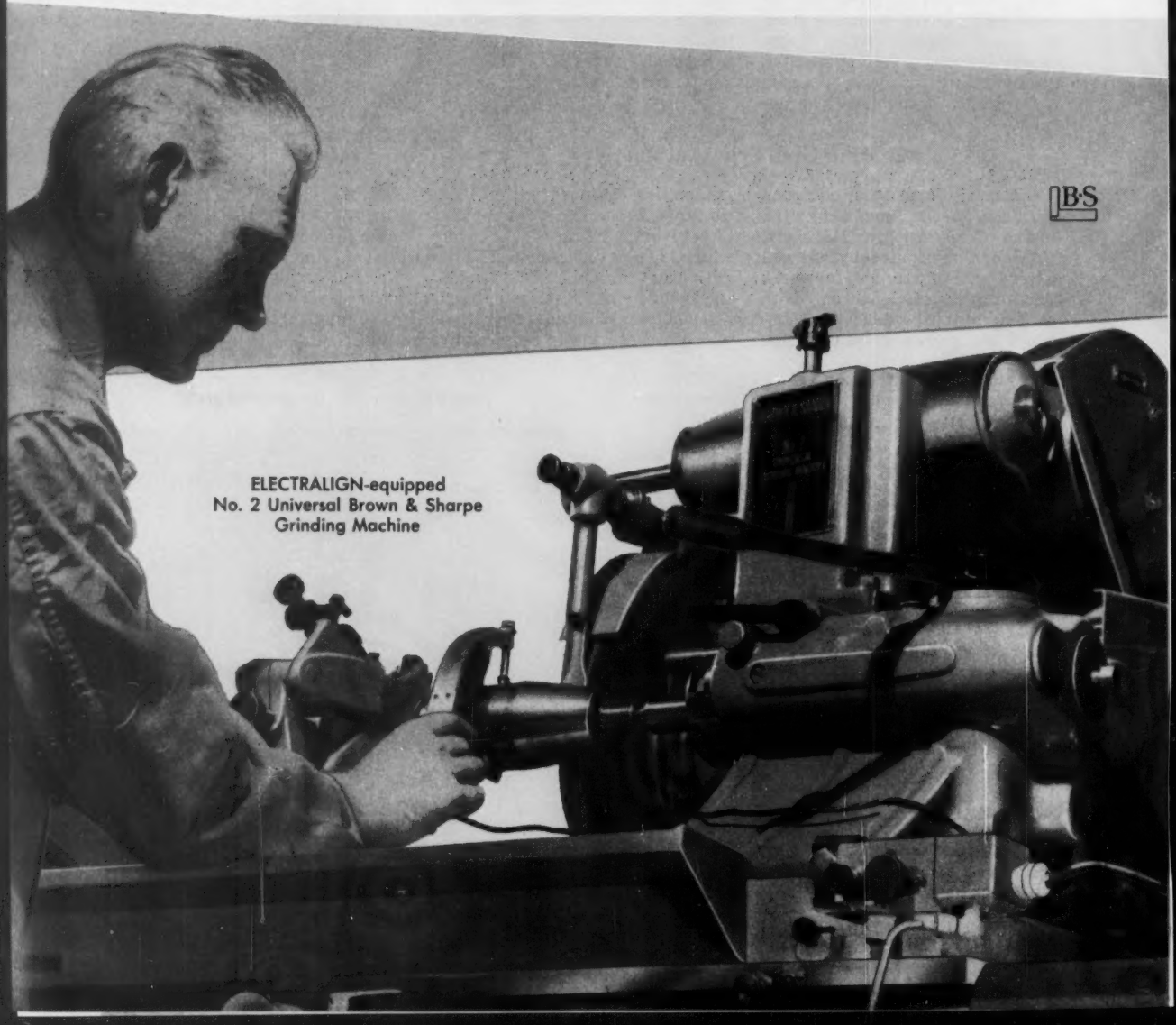

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ELECTRALIGN® provides instant alignment to 0.0001" after only one preliminary grind . . . without calculations. Operator merely sets dial to working length of piece and adjusts pointer to show taper error. Then he swivels table until pointer reads zero, and grinds to finish . . . with practically full tolerance for sizing! And size control to 0.0001" is a cinch with ELECTRALIGN's precision electronic caliper. Operator can easily measure pieces to 0.00001" . . . often right in the machine!

ELECTRALIGN GRINDING speeds set-ups, steps up productivity, minimizes spoilage — radically reduces costs in tool-room and production work. Write for complete details. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

ELECTRALIGN can be used for either alignment or gaging merely by turning selector switch. This modern electronic aid to precision is available on all Brown & Sharpe Universal and Plain Grinding Machines and the No. 13 Universal and Tool Grinding Machine.

said to make this machine well adapted for general press work in automotive and bus repair shops, maintenance shops, service stations, and railroad repair shops.

The hydraulic cylinder of this press is of welded construction and permits the use of rams of various hydraulic travel capacities. Ease of operation is said to be insured through an improved mechanism that gives more accurate control for raising and lowering the table.

Other features of the device include side openings in the upright members to permit straightening long shafts; and a mechanism that allows press heads to be moved longitudinally across frame.

Circle Item 191 on postcard, page 255

Moline Drilling Machine

A Model HU110 multiple-spindle drilling machine is a recent addition to the line manufactured by the Moline Tool Co., Moline, Ill. This universal drilling machine is equipped with hydraulic feed. It has two-speed-and-neutral adjustment for each spindle driver. The drivers are designed for easy installation or removal, each driver assembly being made up as a unit that includes the speed adjusting mechanism, anti-friction bearings, and driven gear.

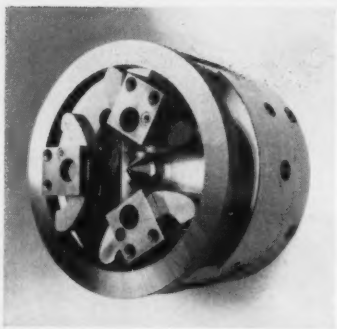
The entire spindle unit of this machine, which normally moves on vertical ways, can also be used in any angular position.

The machine has a 15- by 24-inch drilling area and can be equipped with a maximum of twenty-four two-speed-and-neutral spindle drivers. Maximum rated capacity of the multiple-spindle drive unit is 15 H.P. The feed cycle is automatic with electric push-button control.

Circle Item 192 on postcard, page 255

Buck Compensating Chuck

The Buck Tool Co., Kalamazoo, Mich., announces a new type compensating chuck, designed to provide true equalization. The high degree of accuracy claimed for this chuck is said to be accomplished by reducing friction and simplifying the parts in the compensating mechanism. Easy changing from one diameter to another; equally good operation with the machine running or stopped, which allows automatic loading and unloading; compensating mechanism that increases the gripping power, permitting more rapid stock removal; a center that can easily be set dead true; and provision for use as a standard power chuck when required, are advantages claimed for this new chuck.



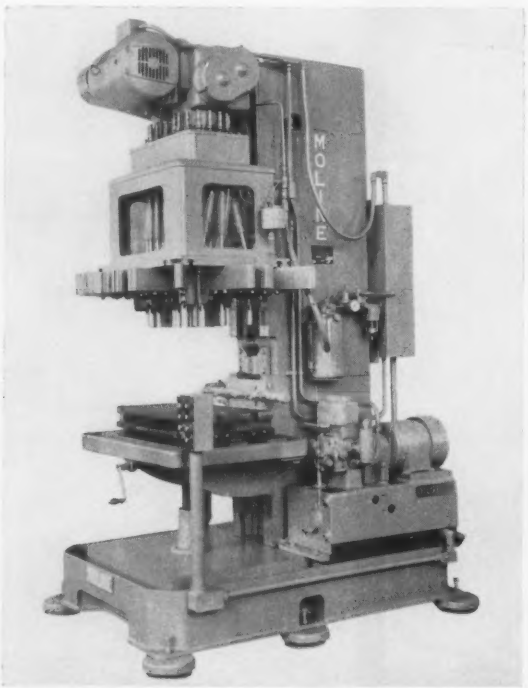
Compensating chuck announced by the Buck Tool Co.

Circle Item 193 on postcard, page 255

Steel-Cutting Carbides

The Willey's Carbide Tool Co., Detroit, Mich., has developed two new carbide grades, Series 8-A and 6-A, specifically designed for

(*Continued on page 248*)



Moline multiple-spindle drilling machine

Willey's vacuum sintered carbide blanks and materials

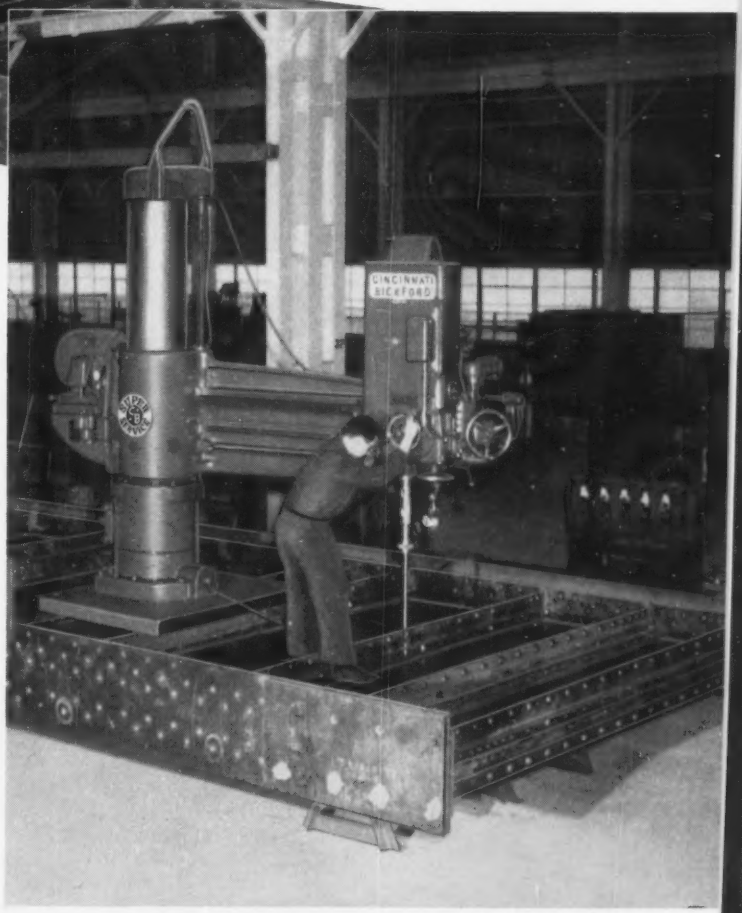
CINCINNATI BICKFORD

saves 50% to 75%

AT LINK-BELT COMPANY

Instead of positioning this 57,100 pound girder for drilling operations, the machine is moved by crane to the job.

This 6-foot arm, 17-inch diameter column Cincinnati Bickford Super Service Radial Drill is equipped with a lifting bail for portable use on large structural members and base plates where it is much faster to move the machine than the work. The machine is never clamped to the piece or floor for these portable drilling operations since it is properly balanced and of ample weight to neither tip nor rise up while drilling. Various sizes of holes are drilled in the part shown. Savings of 50 to 75 per cent over the previous method which used two men and a portable air drill, have been effected.



Photos made at the new Link-Belt Company plant in Colmar, Pa.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION

Cincinnati 9, Ohio, U.S.A.

GIDDINGS & LEWIS MACHINE TOOL CO. : Fond Du Lac, Wisconsin

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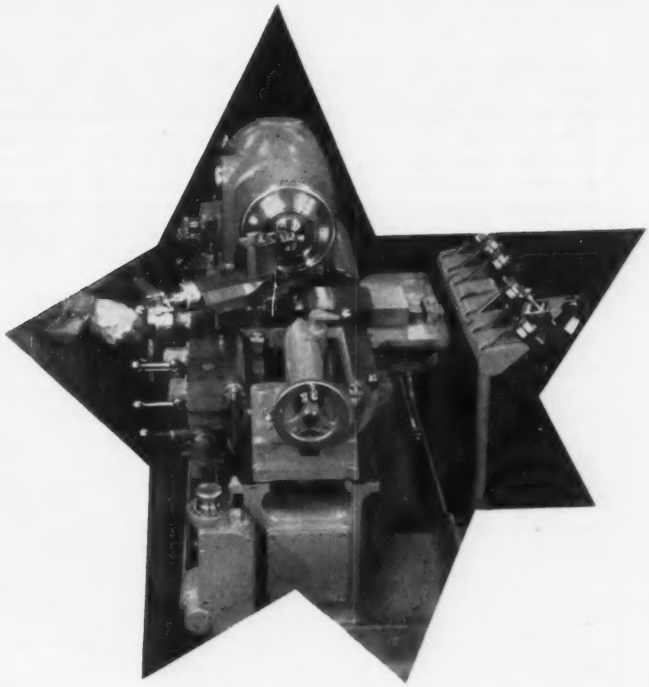
and youive
made a
tool change !

Pre-Ground, Pre-Calibrated Monarch *QUIK-TOOL* Ready-Set Tooling Provides Immediate Tool Change



Tool block fits any standard Monarch 10" Model EE Toolmaker's or Manufacturing Lathe compound rest "T" slot. Tools can be used in any combination or sequence for turning, boring, facing, chamfering, grooving, necking, threading, knurling, or cut-off. The tools automatically position themselves.

What's Quik-Tool? It's a tool block and set of seven tool holders, all precision ground and pre-calibrated to provide better accuracy of positioning and response than you get from any turret.

And it's fast! Tools automatically position themselves when slipped onto a locating pin and swung into the slot of the tool block. They don't even have to be aligned or clamped into position, as the precision fit of tool holder and tool block insures rigidity and accuracy.

Monarch Quik-Tools are specifically valuable in the toolroom or instrument shop for practically any type of turning, with tools used in any desired combination or sequence. The standard tool setups can be used, without adjustment to tool settings, for a wide variety of jobs. Holders are designed for standard tools and gages.

How about it? Don't you want to know *all* about how Monarch Quik-Tool eliminates lengthy setups and cuts tool change time to seconds? Send for our complete illustrated booklet today . . . ***The Monarch Machine Tool Company, Sidney, Ohio.***

Fill Out This Coupon and Clip to Your Business Letterhead, Please.

Monarch
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY,
SIDNEY, OHIO

Please Send Me Your Illustrated Quik-Tool Booklet #306.

NAME_____

TITLE_____

machining tough steels, alloy steels and high tensile strength steels. These vacuum sintered carbides, 8-A for roughing cuts and 6-A for finishing cuts, are said to permit 30 per cent higher feed and speed rates in steel-cutting operations than previously obtained. Exceptional edge strength coupled with unusual wearing qualities and greater resistance to cratering are outstanding qualities claimed for these new cutting tool materials. They are available from stock in all standard sizes.

Circle Item 194 on postcard, page 255

Heavy-Duty Microhoning Machine

A heavy-duty Model 450 "Hydrohoner," with a maximum hydraulic head stroke of 50 inches and a work-diameter capacity of 15 inches, has been designed and built by Micromatic Hone Corporation, Detroit, Mich. This machine is equipped with an eight-speed transmission, variable delivery hydraulic pump with tank unit and controls, and a safety interlock to hold the head in the up position. Either remote-control mechanical feed or automatic hydraulic tool expansion is available.

This machine can be adapted to both internal and external honing with provisions for changeover in a minimum of time. After honing the bore of the recoil cylinder, the table moves out to clear the spindle for the honing operation on the floating piston rod. To facilitate loading and inspecting, the internal honing fixture is made with a tilt-down arrangement. The rod, keyed to the spindle in the upper end and mounted on a live center at the bottom, is rotated and reciprocated through the external honing tool. In removing approximately 0.025 inch stock from the cylinder and 0.006 inch stock from the rod, a geometric tolerance of 0.0001 inch is held while obtaining a finish of 1.5 micro-inches r.m.s.

Circle Item 195 on postcard, page 255

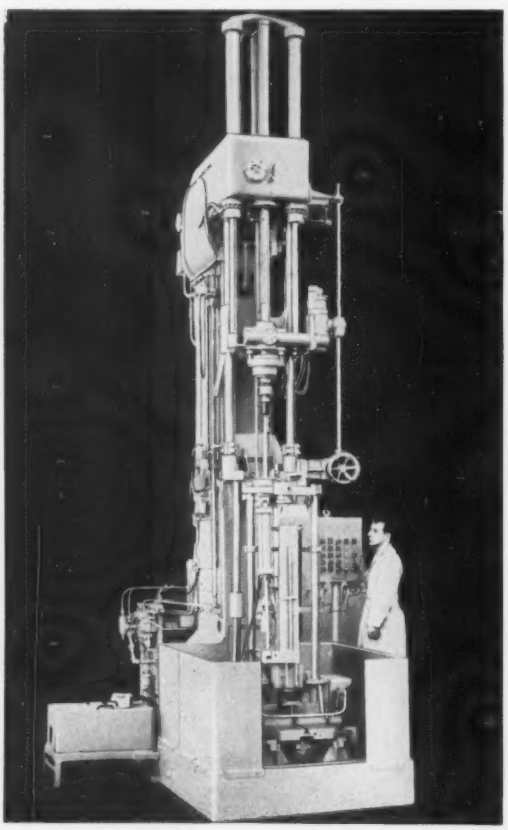
Improved Abrasive-Belt Grinding Machines

Four improved models of the Delta 2 1/2-inch abrasive-belt grinding machines, having new rubber contact wheels and improved belt alignment features, have been introduced by the Delta Power Tool Division of the Rockwell Mfg. Co., Pittsburgh, Pa. The new contact wheels are said to give a better finish in less time and to reduce costs by increasing the life of the abrasive belts. The wheel hubs are designed to accommodate standard tires 2 1/2 inches wide and 6 inches in diameter so that tires can be easily replaced when they become worn.

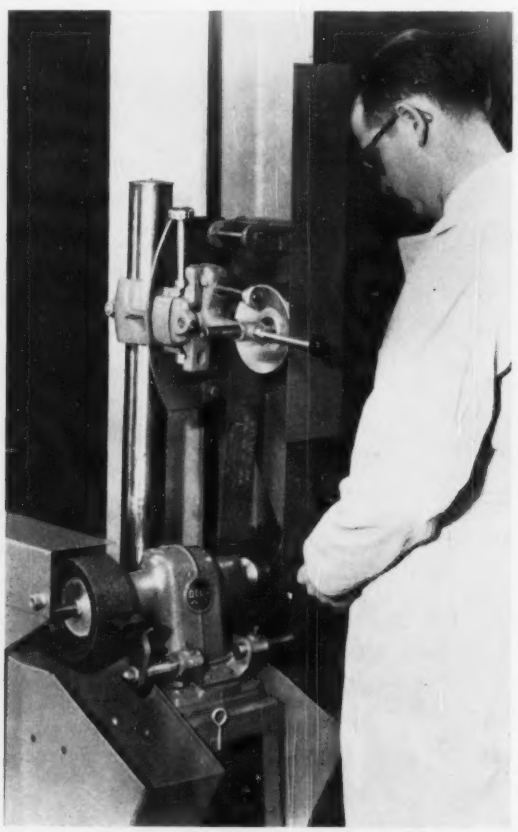
The backstand idler units in the new models are designed to permit lateral adjustment of the drum. The hand-knob control for belt tracking adjustment is retained in the new machines, which are now being shipped to dealers as assembled units.

Circle Item 196 on postcard, page 255

(This section continued on page 250)



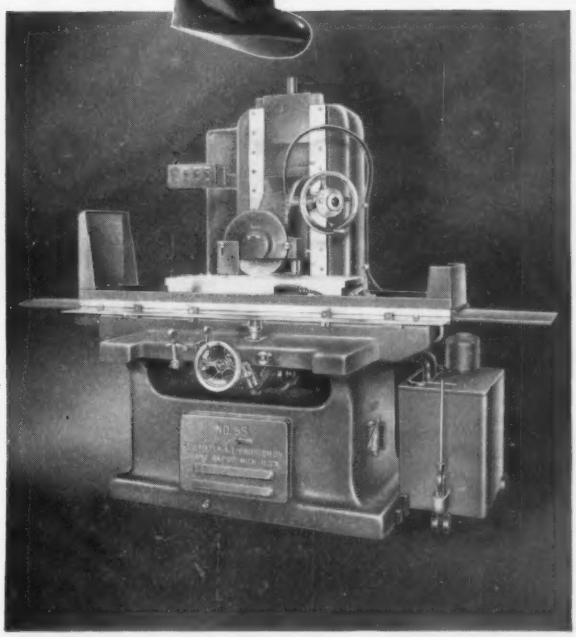
"Hydrohoner" heavy-duty microhoning machine



Delta improved abrasive-belt grinding machine

FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

GRAND RAPIDS GRINDERS



GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER
This precision tool room type machine has table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

Just a note on your letterhead will bring you full details.

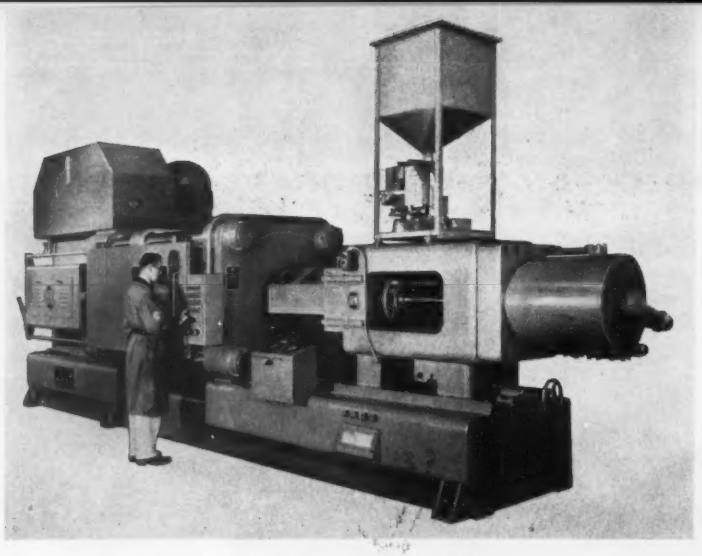
Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . depends on them for the uncompromising precision on which records and reputations are made.

Grand Rapids Grinders are engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

That's why so many tool room men insist on Grand Rapids Grinders.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY 305 Straight Ave., S.W., Grand Rapids, Michigan



H-P-M injection molding machine

Plastics Molding Machine

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has announced a new plastics injection molding machine having a polystyrene molding capacity of from 48 to 64 ounces. This is claimed to be the fastest unit of its size now available. Known as the Model 800-H-48, it features a high injection speed of 2410 cubic inches of material per minute; a mold-mounting area of 36 by 54 inches; and a 35-inch mold clamp stroke.

The machine incorporates an automatic weighing type feeder of a compensating design as standard equipment. A dual injection pump permits two-speed injection and dual-pressure injection. This timed control arrangement permits the injection pressure to be reduced automatically after the mold cavities have been filled.

A new, high-output, plasticizing chamber is equipped with three heat zones, each pyrometer controlled. Heating bands are mounted directly on the spreader. The heating chamber can be easily removed for cleaning by means of wedge locks. A quick-change ram spacer permits the use of thin molds without bolsters.

Circle Item 197 on postcard, page 255

Resistance Type Strain Gages for Experimental Use

New SR-4 resistance type strain gages for use at temperatures up to 1800 degrees F. are announced by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. These gages are of the etched foil type, licensed and manufactured under Technograph patents. They are offered for experimental use without guarantees and are available in kits including ten gages, four types of cement with different temperature limits, detailed instructions for use, and tools developed to simplify their application.

The gages consist of an etched foil grid 0.0005 inch thick on a temporary carrier which is stripped off when applying them, leaving the grid embedded in a ceramic cement. Nichrome, Nichrome V, and Constantan grids are available in gage lengths of 1, 1/2, and 3/8 inch. Temperature limits of the four cements are 700, 900, 1100, and 1800 degrees F. Tests in Baldwin laboratories indicate that the gages can be used in static tests up to approximately 1100 degrees F. Above this temperature the gages can be used only for dynamic tests. Nominal resistance of the gages is between 97 and 120 ohms. The ten gages have resistances within plus or minus 0.2 ohm of each other.

Circle Item 198 on postcard, page 255

Strain gage equipment for experimental use announced by Baldwin-Lima-Hamilton Corporation

Scott paper wipers in new carton

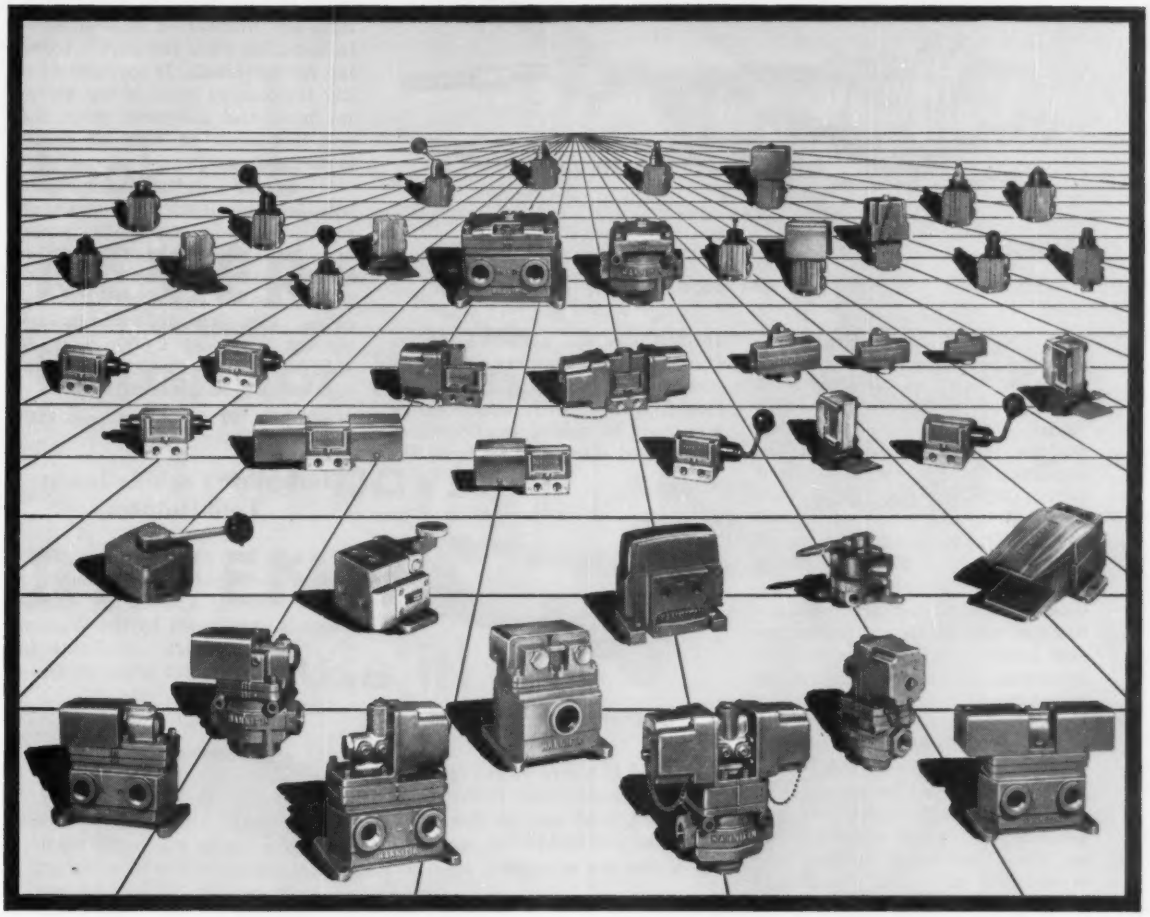
Scott Paper Wipers

Disposable, specially treated paper wipers manufactured by the Scott Paper Co., Chester, Pa., for heavy machinery and small precision parts, as well as for face and hands, are now available in two sizes. The original wiper, 9 5/8 by 13 5/8 inches, and the new wiper, 9 5/8 by 10 1/4 inches, are identical except for size and cost. They are packaged in newly designed "pop-up" boxes, each containing 125 wipers. The boxes are packed eighteen to a case.

Circle Item 199 on postcard, page 255

(This section continued on page 252)

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜″ to 1¼″. 2-way, 3-way and 4-way.

P-M Master Valves. ¾″ to 1¼″. 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼″ and ⅜″.

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛″ to ¾″.

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

Stock Delivery On All Types

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MAIL THE COUPON FOR PROMPT ACTION

- ☐ Have Field Engineer call at once
- ☐ Have Field Engineer stop by soon
- ☐ For the present, just send complete Hannifin Control Valves Catalog

Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Illinois

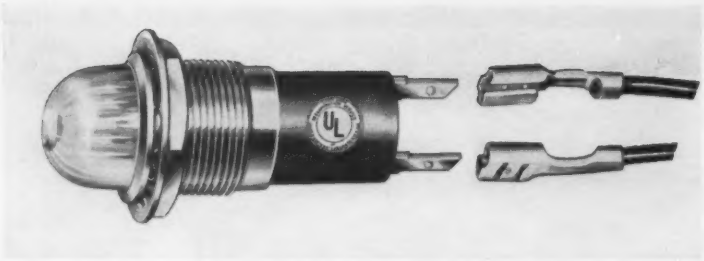
Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

For more information fill in page number on Inquiry Card, on page 255



Dialco pilot with spade terminals

New Pilot Lights

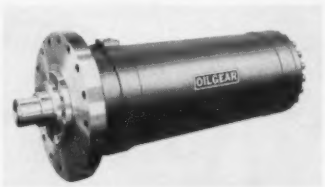
A new series of "Dialco" pilot lights with spade terminals to fit "quick connect" type wire connectors is being added to the line manufactured by the Dialight Corporation, Brooklyn, N. Y. This terminal is said to provide cost-saving advantages on the assembly line, as well as in maintenance work. The company's regular indicator lights that accommodate bayonet type miniature lamps are now available with the new spade terminals. These terminals are the matching part for the convenient "quick connect" type wire terminals and the connection is made positive with triple spring action.

This series can be mounted in an 11/16-inch clearance hole and permits the use of a wide range of screw and friction lens caps with lenses of varied shapes and colors.

Circle Item 200 on postcard, page 255

Hydraulic Press Cylinder

A special double-acting hydraulic press cylinder designed and custom-built by the Oilgear Co., Milwaukee, Wis., is shown in the illustration. This cylinder has a 16-inch bore and a 36-inch stroke. It operates at pressures up to 2000 pounds per square inch. The cast-steel front head with reverse flange mounting is welded to one end of the forged steel cylinder, and the



Oilgear hydraulic press cylinder

rear head is bolted to the opposite end. Bearing-bronze bushings in the front head and on the piston guide the ram and piston assembly.

Circle Item 201 on postcard, page 255

Milling Attachment for Automatic Screw Machines

Turnmill Inc., Center Line, Mich., has brought out a milling attachment for use on any standard automatic screw machine. This "Turnmill" attachment applied to multiple-spindle automatic screw machines, as shown in Fig. 1, permits any number of flats or slots to be milled while the part is turning in the spindle. It operates during the normal cycle of the screw machine and advances with the end tool slide, or with an accelerated movement.

"Turnmill" attachments are available for all sizes and makes of multiple-spindle automatic screw machines. They can be set up quickly and easily, and are adjustable to the full capacity of the machine. Concentricity within accuracy limits of 0.0001 inch is said to be assured because the cutters rotate around the stock.

Circle Item 202 on postcard, page 255

Indexible Carbide Insert Tool-Holders

A new line of indexible carbide insert tool-holders designed for offset turning and facing operations is announced by the Wesson Co., Detroit, Mich. Available in right- or left-hand offset styles—

"Multicut" offset tool-holder developed by the Wesson Co.

Model GAR or GAL—this latest extension of the "Multicut" holder series is able to perform either facing or turning or a combination of both in one operation. Four sizes are available for either right- or left-hand mounting.

Circle Item 203 on postcard, page 255

Fig. 1. Automatic screw machine equipped with "Turnmill" milling attachment

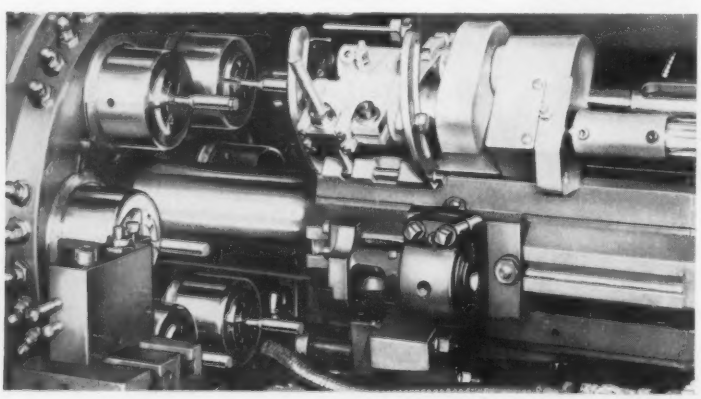


Fig. 2. Examples of work performed by "Turnmill" attachment

Look into REVERE Phosphor Bronze – it pays RAVENNA to use it!

This Moen Single Handle Mixing Faucet contains an anchor disc and an anchor washer, both stamped out of Revere Phosphor Bronze Strip. These are small parts, but in a fine product such as this faucet, high quality metals must be used throughout. Here is a condensation of the manufacturer's experience with the phosphor bronze:

Anchor Disc: • Standard punching speed maintained. • No pre-straightening off the arbor for the automatic punching process. • No excessive die wear. • Corners are sharp and clean; no de-burring needed. • Natural mill finish is better than they could achieve by tumbling or burnishing. • High tin content means no lubrication is required; they call it "silent brass."

Anchor Washer: • Have not had a single surface failure. • Dry tumble to de-burr. • Good fatigue characteristics and no obvious signs of corrosion.

Revere offers several types of phosphor bronze, each with slightly different characteristics. In addition to this alloy, Revere also supplies Ravenna with round and octagonal leaded brass tube and free-cutting brass rod, for use in various parts of the valve. We will be glad to collaborate with you on selection of just the right forms of the correct alloys for your products, present or projected. See the nearest Revere Sales Office.

Moen Single Handle Mixing Faucet, made by Moen Valve Co., Division of Ravenna Metal Products Corp., 6518 Ravenna Ave., Seattle 15, Wash.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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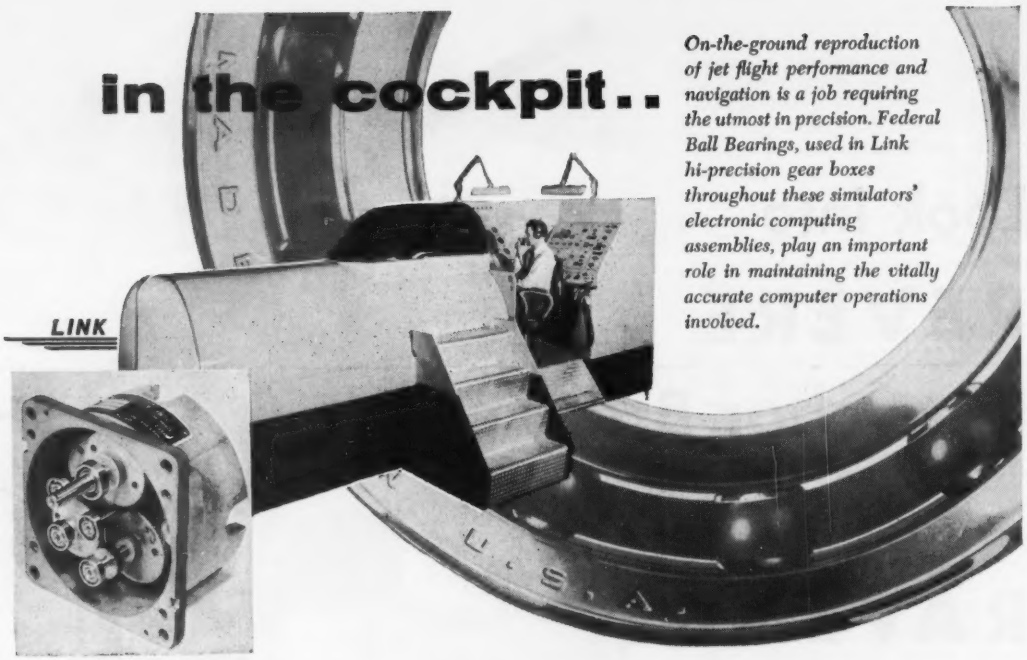
"The Revere Four-Way Service" is a 16 mm. sound motion picture in color, educational and informative. If you haven't seen it, write nearest Revere Office.

in the cockpit..



On-the-ground reproduction of jet flight performance and navigation is a job requiring the utmost in precision. Federal Ball Bearings, used in Link hi-precision gear boxes throughout these simulators' electronic computing assemblies, play an important role in maintaining the vitally accurate computer operations involved.

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From trainers for pilots to tractors for ploughs—in home, office, machine shop—wherever you find mobility—you'll find Federal Ball Bearings helping to keep things moving. Hundreds of types—more than 12,000 sizes! And all produced by a company that has devoted 50 years to the manufacture of ball bearings . . . exclusively.

When Federal Ball Bearings are part of so many things you *use*, shouldn't they be part of the things you *make*?

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or the cornfield...

Less glamorous, perhaps, than jet flight simulators—but as essential as the food they help cultivate—are these rugged, hard-working, dependable tractors. And ruggedly reliable Federal Ball Bearings are here, too.

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One of America's Largest Ball Bearing Manufacturers

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PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

DETERGENTS—Oakite Products, Inc., 126 Rector St., New York City. Revised booklet on solvent detergents—cleaning materials that combine the oil- and carbon-dissolving abilities of solvents with the penetrating, wetting-out and water-rinsing qualities of surface active agents. The 16-page booklet tells how to remove oily films; smuts; cutting, drawing, and stamping compounds; zinc chromate primers from aluminum; and synthetic paints from steel. Various methods of application are described. Copies of the booklet are available by writing on company letterhead to the above address.

GAGES—Threadwell Tap & Die Co., Greenfield, Mass. 112-page combination gage catalogue and textbook. The catalogue section covers cylindrical plug gages, tap gages, master setting discs, cylindrical ring gages, adjustable-limit gages, thread gages, thread production and checking equipment, and pipe thread gages. Engineering data in the textbook section is divided into three parts: one part covers gaging policy, tolerances, care control, and use of cylindrical gages. Another part covers thread gages and includes gage terminology, formulas for gage dimensions, tolerance tables, gage blank dimensions, and a history of the Unified screw thread system. A third part deals with pipe thread gages and covers gaging practice; specifications for NPT, NPTF, and ANPT threads; tolerances; interpretation of step markings on pipe thread gages; and specifications of American Standard straight pipe threads. . . . 1

MARKING DIES—Jas. H. Matthews & Co., Pittsburgh, Pa. Catalogue 146-B, containing information on the marking of steel dies. Data is given on the following: use and selection of steel dies for every application; steel stamping, embossing and foil-leaf marking dies; press style type holders, toolpost holders for marking around peripheries of cylindrical or round tapered parts; and numbering heads for embossing and debossing. 2

HYDRAULIC MACHINERY—Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N. J. General bulletin 110-D, describing the complete line of machinery built by the concern. Detailed information is presented concerning injection, compression, and transfer molding machines for the plastics industry; extrusion presses for ferrous and nonferrous metals; metal-working equipment; railroad shop equipment; ordnance equipment; and standard and special machinery for general industrial use. 3

CHUCKS—Horton Chuck Division of the E. Horton & Son Co., Windsor Locks, Conn. Catalogue E-200 designed to simplify the specifying and buying of chucks. A visual reference index enables quick location of the type of chuck desired. Illustrations and dimensioned drawings are provided for all chucks, jaws, and other parts. Independent, universal, combination, light-duty, and two-jaw chucks are listed, as well as faceplate and boring mill jaws. 4

FORK TRUCKS—Automatic Transportation Co., Chicago, Ill. Two 4-page bulletins give construction specifications of Transveyor fork trucks, including details of frame, uprights, cantilever, and traction drive axle. Electrical features described include motors, travel controls, lift and retracting controls, travel and elevating devices, and running and charging plugs. Full information is also supplied on the mechanical system. 5

WIRE THREAD INSERTS—Heli-Coil Corporation, Danbury, Conn. Design manual and catalogue 625 A which supplies 22 pages of data intended for engineers in the automotive, aviation, military, and general industrial fields who are engaged in design work on aluminum, magnesium, plastics, wood, iron, and steel. For engineers working on military applications, a separate bulletin 689 A gives military standards for drilling depths, classes of fits, and gages. 6

WELDER—Lincoln Electric Co., Cleveland, Ohio. Bulletin describing the Weldanpower, a 200-ampere welder, designed for fast, easy welding, hard surfacing, soldering, brazing, torch heating, and cutting. The equipment is designed to provide a low-cost method of handling a wide range of arc-welding and emergency power needs. It can be quickly moved to locations where line power failure has occurred or where existing power supply is inadequate. 7

AUTOMATIC PRODUCTION LATHE—Sundstrand Machine Tool Co., Rockford, Ill. Bulletin VL-1 describes a new vertical automatic production lathe that is basically a standard machine equipped with platens for mounting, turning, or grooving slides; multiple tool slides; and tracer slides. Several tooling set-ups are shown to indicate the wide application of the machine for production turning. Machine capacities range from 5 to 25 H.P. 8

LATHES AND OTHER MACHINE TOOLS—South Bend Lathe Works, South Bend, Ind. Golden anniversary catalogue of 80 pages covering the entire line of precision engine lathes, tool-room lathes, turret lathes, shapers, pedestal grinders, drilling machines, and milling machines. A vertical spindle milling machine and a turret lathe with a 13-inch swing are shown for the first time. Attachments, chucks, tools, and other accessories are included. 9

TRANSFER MACHINES—W. F. & John Barnes Co., Rockford, Ill. "Automatic Progress-Thru Machines for Processing

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Cylinder Blocks," 12-page catalogue, describes machines ranging from a twenty-eight-station unit performing 132 separate operations to the smaller four- and five-station machines for fewer operations. Operations performed on each machine are enumerated along with other specifications, and close-up views of work-pieces are included. 10

ALLOY STEELS—Lukens Steel Co., Coatesville, Pa. Booklet on the company's high-strength, readily welded, weight-saving "T-1" alloy steel. Use is made of charts, graphs, sketches and photographic illustrations in describing this new engineering material which is available in thicknesses from 3/16 inch to 6 inches and above, and in standard widths up to and including 195 inches, with a maximum length of 720 inches. 11

ALUMINUM FOR HEAT EXCHANGERS—Reynolds Metals Co., Louisville, Ky. 16-page brochure giving application information and data on the use of aluminum in heat exchangers. Design information section lists recommended alloys for heat-exchanger components. Fabrication considerations for heat-exchanger applications are also discussed, and the company's engineering services are briefly described. 12

SPECIAL STEELS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. 16-page booklet entitled "Special Steels for Industry" gives details pertaining to stainless steels, electrical materials, Carmet carbide materials, and tool steels manufactured by the corporation. Numerous charts give analysis of various steels, as well as detailed information concerning properties and fabrication methods. 13

CARBIDE INSERT HOLDERS—Wesson Co., Ferndale, Mich. Bulletin covering Multicut series of holders for no-grind indexable carbide inserts with adjustable chip breaker clamps. Prices and specifications are listed for seventy-eight holder models designed for boring, turning, chamfering, plunge cutting, recessing, and other related operations. Throw-away inserts for these holders eliminate grinding. 14

THREAD PLUG AND RING GAGES—Besly-Welles Corporation, Besly-Metro Gage & Tool Division, Beloit, Wis. 32-page catalogue includes complete tables of sizes and prices for thread plug, thread ring, thread setting plug, plain cylindrical plug, plugs and rings, and master setting discs. Included is an illustrated visual index which makes it easy to find and select proper gages for every application. 15

DIRECT-CURRENT MOTORS AND GENERATORS—General Electric Co., Direct Current Motor & Generator Department, Erie, Pa. Specification sheets GEC-1372 and 1373 provide detailed information on G-E direct-current Kinamatic motors and generators. The motors have ratings from 1/2 to 150 H.P., and the generators, from 3/4 to 100 kilowatts. Applications, performance, and construction features are described. 16

CONE-DRIVE SHAFT-MOUNTED REDUCERS—Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich. Bulletin CD-400 describes extensive line of shaft-mounted reducers. Dimensioned assembly drawings, horsepower and torque rating charts, and application photographs are presented, as well as complete specifications concerning bore sizes and gear mountings. Instructions for mounting are included. 17

WIRE DRAWING MACHINES—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. 8-page booklet 786-W-3 illustrates and describes continuous Tandem wire drawing machines built by the company. Included are drum, plug, and combination types for drawing brass, copper, aluminum, and other nonferrous metals. Illustrations of machines with various types of drive and packaging arrangements are covered. 18

COLLETS—Hardinge Brothers, Inc., Elmira, N. Y. Bulletin 56 which constitutes a guide for the selection of collets required on lathes, milling machines, grinding machines, and various types of fixtures. Specification and dimension charts, conversion and interchangeability listings, and prices are presented in simplified form for easy reference. Information on collets for nose type chucks is also given. 19

UNIVERSAL FIXTURES—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 31255 shows how quick set-ups and easy change-overs can be made to accommodate a wide variety of boring, turning, and facing operations on standard precision boring machines by means of universal fixtures. Included are both single and two-spindle set-ups, as well as horizontal, vertical, and angular fixture applications. 20

ADHESIVES, COATINGS, AND SEALERS—Adhesives & Coating Division, Minnesota Mining & Mfg. Co., Detroit, Mich. 12-page catalogue listing properties and applications of a wide variety of adhesives, coatings, and sealers. Typical applications for metal-working, transportation, general manufacturing, electrical manufacturing, and other industries are listed in comprehensive tables. 21

GEARMOTORS AND MOTOGEARS—Link-Belt Co., Chicago, Ill. 28-page booklet 2447 which includes complete selection data pertaining to a new line of Gearmotors and Motogears. Load classifications, dimension tables, over-hung load ratings, and mounting assemblies are given. Both products are in keeping with the new NEMA motor sizes. Information is also given pertaining to flexible and fluid couplings. 22

SCREW-MACHINE PRODUCT COSTS—Eastern Machine Screw Corporation, New Haven, Conn. Bulletin describing the use of nomographs for estimating the costs of screw-machine products which may also be applied to practically all machining operations. There are nomographs for determining the weight of material, number of revolutions, number of seconds, and cost per thousand pieces. 23

METAL FORMING— Marblette Corporation, New York City. Series of bulletins that outlines the manufacturing, use, and advantages of plastic draw dies, stretch press dies, and hydraulic forming dies. The bulletins are based on experience in developing epoxy and phenolic resins and in the operation of tool and die shops and toolmaking departments in the automotive and aircraft industries. ...24

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

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1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52 53 54

NEW SHOP EQUIPMENT

101 102 103 104 105 106 107 108 109 110 111 112 113 114
115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144 145 146 147 148 149 150 151 152 153 154 155 156
157 158 159 160 161 162 163 164 165 166 167 168 169 170
171 172 173 174 175 176 177 178 179 180 181 182 183 184
185 186 187 188 189 190 191 192 193 194 195 196 197 198
199 200 201 202 203 204 205 206 207 208 209 210 211 212

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BRASS AND ALUMINUM NUTS—Fischer Special Mfg. Co., Cincinnati, Ohio. 16-page catalogue No. 55, covering the company's line of turned brass and aluminum nuts. Descriptions and specifications for standard and hexagonal nuts, open- and closed-end cap nuts, and knurled thumb nuts, as well as for the company's lighting fixture, spark plug, and battery nuts are given. **25**

AIRCRAFT STEELS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. 68-page booklet gives condensed information relative to Army, Navy, and Government specifications for aircraft steels. Essential factors of aeronautical specifications are provided to make the booklet a reliable guide in specifying aircraft-quality steels. Sizes, shapes, and qualities of alloy and stainless steels are given. **26**

MILLING MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue M-1915 describing dial type, plain, universal, and vertical milling machines, built in No. 2, 3 and 4 sizes. The plain and vertical models are available with or without automatic table feed cycles. Machines are designed for a high degree of operating convenience. General specifications are given for all sizes and types. **27**

ROTARY INDEX-TABLE—General Automation Products Co., Birmingham, Mich. Circular describing Accro-Dex rotary index-table which may be supplied with built-in automatic switch actuators. Up to 150 index movements can be made per minute with a table having twenty-four stations. The table is 12 inches in diameter and can be supplied with 4, 6, 8, 12, or 24 stations. **28**

TECHNICAL DATA CARD—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. Data sheet TDC-155A, summarizing the company's recommendations for joining, by arc-welding procedures, various tubing steels. In addition to indicating the proper electrodes to use, it provides information about preheating and postwelding heat-treatments. . . . **29**

BRAZING AND SOLDERING—Selas Corporation of America, Philadelphia, Pa. Circular S 1050, describing production methods of brazing and soldering through the application of automatic machines. Various types of custom-built machines are illustrated, and information is presented relating to temperatures employed, production obtained, and other details. **30**

WORKING OF STEELS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Data sheet entitled "The Working of Tool and High Speed Steels" contains seventeen charts giving detailed information on these steels. Such items as cutting-tool angles, table of cutting speeds, temperature ranges, heat-treating, and machinability are included. **31**

MOTORS—General Electric Co., Schenectady, N. Y. 12-page publication GEA-6068 dealing with fractional horsepower, direct-current motors and equipment for direct application and built-in use. Included are typical applications, product features, ratings, and specifications for standard models. Availability of engineering and application assistance are outlined. **32**

CYLINDRICAL GRINDING MACHINES Landis Tool Co., Waynesboro, Pa. 20-page booklet illustrates precision cylindrical grinding machines exhibited by the company at the recent Machine Tool Show. Included are integrated production lines, automatic grinders, and standard machines. Sketches are used throughout the booklet to clarify the operations . . **33**

MACHINE TOOLS AND ACCESSORIES—Hardinge Brothers, Inc., Elmira, N. Y. 12-page bulletin 3HA which covers a complete line of precision tool-room and production machines, chucking machines, collets, feed fingers, index fixtures, circular form tools, and cut-off tools. Details are presented concerning various features of the machines, together with complete specifications. **34**

DISC GRINDERS—Besly-Welles Corporation, Grinder Division, Beloit, Wis. Condensed catalogue gives dimensions and specifications for double-horizontal and double-vertical spindle disc grinders, radial head face grinder, single-vertical spindle disc grinder, and many special grinding machines. Also described is the sealed spindle quill and a magnetic rotary feed. **35**

REFLECTOSCOPE—Sperry Products, Inc., Danbury, Conn. Bulletin 50-105, covering the application of the ultrasonic Reflectoscope for the non-destructive testing of products and equipment. The bulletin explains in simplified terms the principle of ultrasonic inspection and illustrates the latest types of available equipment. . . **36**

TUMBLING EQUIPMENT—Baird Machine Co., Stratford, Conn. 24-page catalogue describing construction and giving specifications pertaining to various models of oblique tumbling machines; horizontal tumbling machines; rolling barrels for burnishing hardened steel balls; and wooden, cast, sheet-metal, bottle-shaped, open-mouthed, and japanning barrels. **37**

SPECTROGRAPHIC SUPPLIES—Jarrell-Ash Co., Newtonville, Mass. Catalogue and price list containing 13 pages of special pure materials and alloy standards. Other listings cover carbon and graphite rods and powders; preformed electrodes; photographic plates, film and processing chemicals; and lists of text and reference books. **38**

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AIR CYLINDERS AND INDEXING TABLES—A. K. Allen Co., Brooklyn, N. Y. Catalogue describes complete line of Allenair cylinders, valves, clamps, and dial feed indexing tables. Cylinders include valve-in-head and single- and double-end types. Three different models of dial feed tables are described. . . .**39**

HEAVY PRESS EXTRUSIONS—Kaiser Aluminum's Industrial Service Division, Oakland, Calif. 24-page booklet containing information on the two 8000-ton presses at the company's Halethorpe, Md., heavy press plant. Operating data is given. **40**

ALUMINUM EXTRUSIONS—Revere Copper & Brass, Inc., Aluminum Division, Baltimore, Md. Catalogue describes extrusion process and gives the characteristics of Revere extruded products. Also, information is contained on the design of aluminum extruded products and typical applications. **41**

GEAR DRIVES—Link-Belt Co., Chicago, Ill. 16-page booklet 2651, describing inline helical gear drives. Load classes are given for over 250 applications, as well as over-hung load ratings and dimension tables, instructions for proper selection of drives, and cut-away views of both double and triple reduction drives. . .**42**

SILICONE RUBBER PRODUCTS—Garlock Packing Co., Palmyra, N. Y. 8-page bulletin AD147 describes the complete line of silicone rubber products made by this company. Applications include molded and extruded parts for appliances, automotive and aircraft products, as well as industrial seals. **43**

LEATHER PACKINGS—J. E. Rhoads & Sons, Wilmington, Del. 56-page handbook published by the National Industrial Leather Association contains design and application information for hydraulic and pneumatic leather packings. Such subjects as "What is a Packing and How It is Used" and "Maintenance of Packings" are covered. **44**

HOSE, FITTINGS, AND COUPLINGS—Aeroquip Corporation, Jackson, Mich. Hoses for air, water, fuel, lubrication, and hydraulic applications are described in this 64-page catalogue 200. Information on special hoses for fire-resistant hydraulic fluids, and detachable fittings and couplings, is included. **45**

CARBIDE DRILLS, REAMERS, END-MILLS AND COUNTERBORES—Cleveland Twist Drill Co., Cleveland 14, Ohio. 32-page catalogue describing carbide-tipped and solid carbide drills, reamers, end-mills, and counterbores of a large variety of sizes and styles. Tool dimensions are given as well as net prices. . .**46**

HOLE PUNCHING AND NOTCHING EQUIPMENT—Punch Products Co., Niagara Falls, N. Y. Catalogue describing Unipunch perforating units for hole punching and notching operations. Instructions are provided for mounting the devices singly or in combination. Replacement parts for Wales units are also listed. **47**

SHEET METAL HAND TOOLS—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 78-B illustrates and describes hand tools for sheet metal-working, including snips and shears, hammers, rules, stakes, and other tools. Also included are bending machines, folders, seamers, and beaders. **48**

INJECTION MOLDING—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Bulletin 5601, describing a complete line of injection molding machines for plastics. Operation of the machines is explained in detail and all important specifications are given. Production pictures show examples of plastic ware. **49**

BORING MACHINE—Wadell Equipment Co., Garwood, N. J. Bulletin describing Model VBM, automatic, vertical, precision boring machine designed primarily for use in production shops. The machine has a completely automatic cycle but is sufficiently flexible so that long or short runs can be accommodated. **50**

PRESS CLUTCH CONTROLS—Fawick Airflex Division, Fawick Corporation, Cleveland, Ohio. Circular describing clutch controls for high-speed presses equipped with pneumatic clutch-and-brake. This clutch control is adaptable to old and new presses for efficient operation. **51**

AUTOMATIC VALVES—Rivett Lathe & Grinder, Inc., Boston, Mass. Catalogue 261 illustrates and describes solenoid-controlled and panel-mounted four-way hydraulic valves rated at 3000 pounds per square inch. Features of construction and operation are illustrated by cut-away views. **52**

METAL-CLEANING EQUIPMENT—Circo Equipment Co., Clark Township (Rahway), N. J. 4-page condensed bulletin 521 on standard and special apparatus for grease or dirt removal. Among the units covered are vapor phase, vapor spray, liquid vapor, pit type, and mechanized models. **53**

HIGH-PRESSURE LUBRICATORS—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin 3A, describing high-pressure automatic lubricators applicable to a wide range of machines, such as printing presses; machine tools; and packaging, labeling, and bottling machines. **54**

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15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54		

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101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180	181	182	183	184
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199	200	201	202	203	204	205	206	207	208	209	210	211	212

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29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54		

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156
157	158	159	160	161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180	181	182	183	184
185	186	187	188	189	190	191	192	193	194	195	196	197	198
199	200	201	202	203	204	205	206	207	208	209	210	211	212

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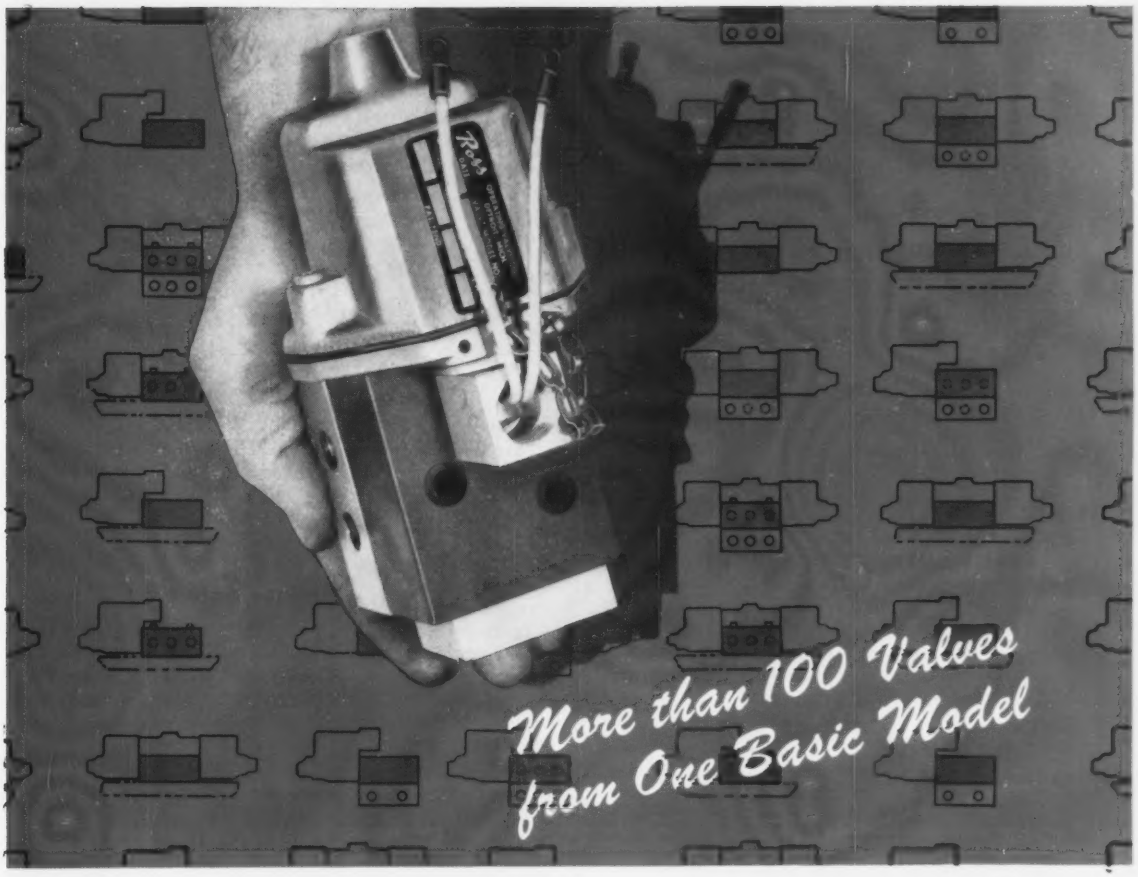

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Between Grinds

By E. S. Salichs

Take Over

The most radical feature of Ford's experimental research vehicle, the Mystere, is the steering wheel which can be positioned on its swiveling arm so that the car may be driven from either front seat. The rhetorical question, "Who's doing the driving anyway?" may be slated, some future day, for a quick answer, "I am."

Posthaste, Professor

Professor O. W. Boston, chairman of the Department of Production Engineering, College of Engineering, University of Michigan, wrote to Associate Editor Charles H. Wick complimenting him on his article in January MACHINERY on the automation of crankshafts. The Professor continued: "Would it be possible for you to send me a set of tear sheets of this article so that I can give it to a student in my class next semester in Parts Processing. I will ask him to make a complete routing sheet and with the illustrations project them on a screen as he presents this material to the rest of the class."

Model Work

Three engineers at the Worcester Polytechnic Institute are currently busy shooting miniature models of bombs and projectiles into tanks of water. Studying the behavior of these models is part of a research program under contract with the United States Navy which wants a projectile that will be stable in its performance under all conditions. The men may recall their boyhood play with water pistols in the bathtub but they are deadly serious about their work now.

Antique Autorama

"Goggles and Gauntlets" is a free-loan film sponsored by the Firestone Tire & Rubber Co., depicting an old-car tour and paying tribute to the auto pioneers. Fifteen-minute running time—the film, that is. The autos do better than that.

Light in the Heel

Some shoe manufacturers are now using aluminum heels on ladies' shoes. They are said to be unbreakable, thin, graceful, and light in weight. But how is impact on the dance floor?

"THE OUTSTANDING YOUNG MAN OF NEW YORK FOR 1955"—Winner of this title is Frederick W. Richmond (center), thirty-two-year-old financier and industrialist, a man whose name is well known in the machine tool industry. For he is board chairman of the Brubaker Tool Corporation; Baker Brothers, Inc.; The Gear Grinding Machine Co.; Birdsboro Steel Foundry & Machine Co.; and National Valve & Mfg. Co. He is also executive committee chairman of Pressed Metals of America, Inc. The award, based on an individual's progress in his business or profession and service to his community, was presented to Mr. Richmond by Edward J. Rock (left) and Eugene P. Friedman (right), president and chairman, respectively, of the Young Men's Board of Trade, New York City's Chapter of the United States Junior Chamber of Commerce. A list of Mr. Richmond's civic activities would, let it be said, match in length his business affiliations. Bit of background: was born in Boston; graduated from Boston University after serving in the Navy; set up an import-export firm while still in college with capital of $1200; and married in 1945. In the Richmond household there is another outstanding young man of New York for 1955—a son!

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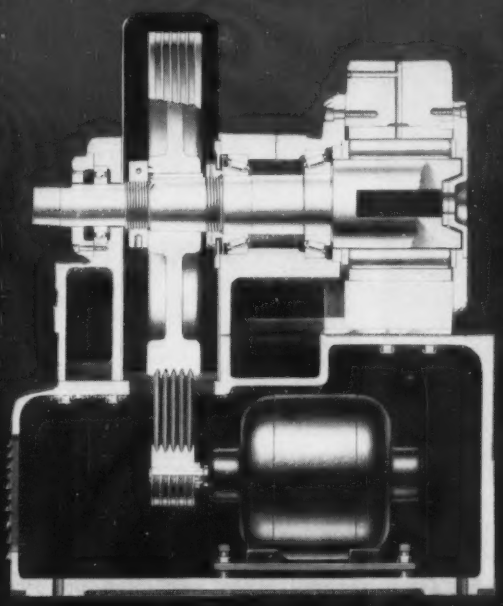
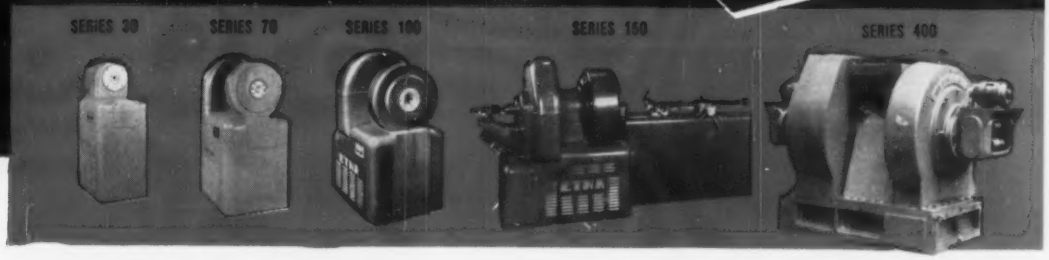
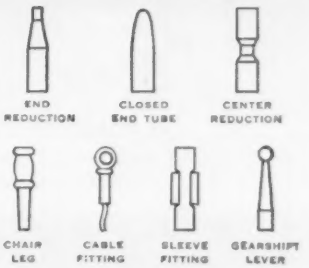
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

Abbey ETNA Company

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electro-motive drive

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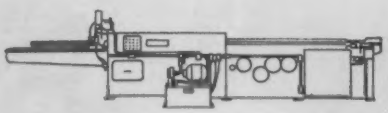

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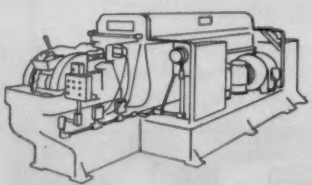

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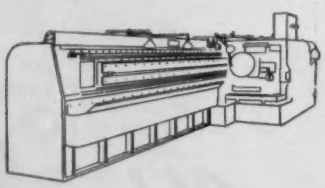

SRHE SINGLE RAM HORIZONTAL, ELECTRIC

BOTTLENECKS

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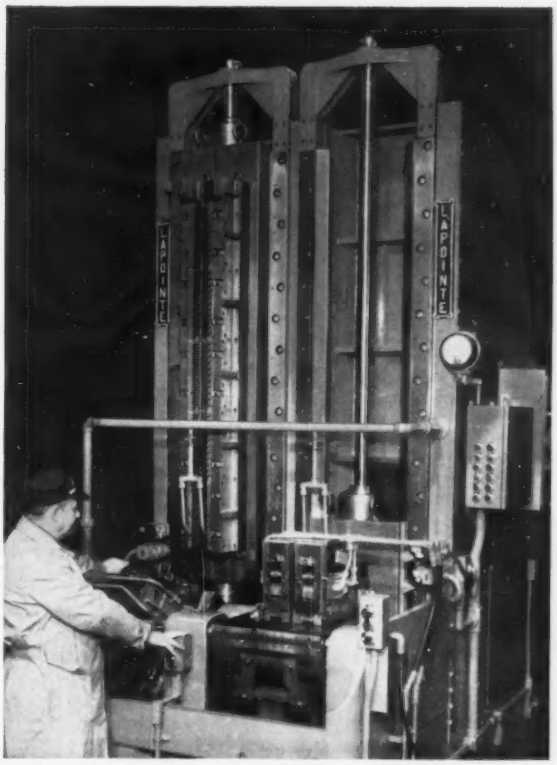
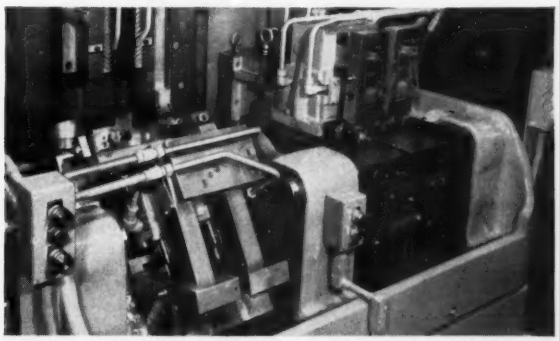
LAPOINTE

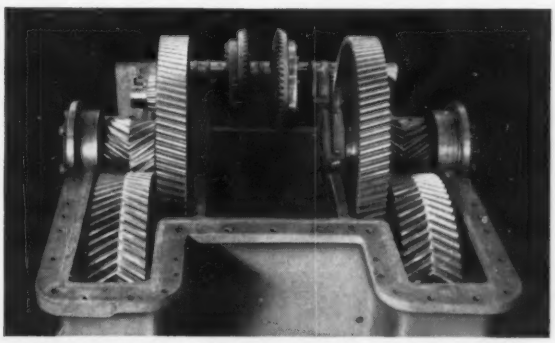
takes all the responsibility for your BROACHING program — we build the broaching **machines**, build the broaching **fixtures**, and make the **broaches!**



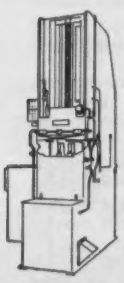
DOUBLE RAM VERTICAL, ELECTRO-MOTIVE DRIVE, LAPOINTE BROACHING MACHINE 40 hp. 70-inch Stroke, equipped with Lapointe-built Fixtures and Lapointe Broaches.



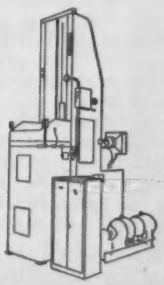
THE EFFICIENT, SAFE TIP-DOWN FIXTURES used on this machine for broaching an automotive front suspension arm are patented . . . and exclusive with Lapointe.



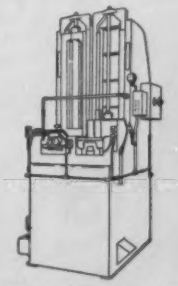
TRAIN OF HEAVY GEARS, for driving the broaches on the 40 hp., 70-inch Stroke, Double Ram Vertical Electro-motive Drive Lapointe Broaching Machine.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

BROACHING MACHINES

News OF THE INDUSTRY

Illinois and Wisconsin

DE LAVAL STEAM TURBINE CO., Trenton, N. J., announces the following appointments: W. H. MOUQUIN has been named district manager of the Chicago office; C. C. BRAY was appointed regional sales supervisor at the same office. These appointments are part of the company's continuing expansion of customer sales and service facilities.

PINES ENGINEERING CO., Aurora, Ill., has purchased Roto-Mation Motors, Inc., St. Clair, Mich. A new subsidiary, Roto-Mation, Inc., has been formed, and will take over the manufacture and sale of the former company's hydraulic-pneumatic oscillating torque motor. All equipment and engineering personnel have been moved to Greenville, Ohio.

JAMES G. TUTHILL has been elected president of the Tuthill Pump Co., Chicago, Ill., succeeding H. T. KESSLER, who has retired. Mr. Tuthill joined the company in 1953. After serving in various capacities in the organization, he was made vice-president in April, 1955.

THOR POWER TOOL CO., Aurora, Ill., has elected JOHN A. MCGUIRE to a full vice-presidency. With Thor since 1939, Mr. McGuire has held the post of vice-president in charge of labor relations since 1953. DEAN C. SMITH, general manager of the Aurora works, was elected vice-president in charge of manufacturing. GEORGE A. KAUTZ, a member of the accounting staff, has been appointed assistant treasurer.

DAVID W. BONNAR was recently appointed assistant sales manager, Clearing Machine Corporation, division of U. S. Industries, Inc., Chicago, Ill. FRANK LONG will handle sales of mechanical and hydraulic power presses in Cleveland, Ohio, for the company.

OVERTON GEAR & TOOL CORPORATION, Addison, Ill., has completed installation of equipment in its new plant, and manufacturing operations are now under way. The company makes a wide range of spur and helical gears.

PARKER RUST PROOF CO., Detroit, Mich., manufacturers of surface treatments for metals, announces that its Chicago sales office is now located at 5875 North Lincoln Ave.

MORSE CHAIN CO., a subsidiary of Borg-Warner, Chicago, Ill., announces the acquisition of Eberhart-Denver Co. of Denver, Colo. and its affiliate, the Spreco Co. of Chicago.

HYDRAULIC PRESS MFG. CO., Mt. Gilead, Ohio, announces an address change for its Chicago area office. The new address is 911 Busse Highway, Park Ridge, Ill.

CHAIN BELT CO., Milwaukee, Wis., announces two promotions: W. B. MARSHALL, with the company since 1920, has been appointed to the new post of manager of market development and sales training. G. H. PFEIFER, formerly advertising manager, moves up to the newly created position of advertising manager.

JESS N. MCCOMBE was made district sales manager of the Milwaukee branch of the Columbia Tool Steel Co., Chicago Heights, Ill. He will service the Wisconsin territory.

John A. McGuire, vice-president, and Dean C. Smith, vice-president—manufacturing, Thor Power Tool Co.

New England

NORTON CO., Worcester, Mass., has elected one new director and three new officers. The director is EDWIN C. EVANS, vice-president and assistant general manager of the Behr-Manning division. The officers are HOWARD J. DALY, vice-president for crude-abrasive plants; WILLIAM H. PERKS, assistant treasurer (in addition to his present position of controller); and CURTIS M. CLARK, assistant secretary. Two new abrasive engineers were appointed, and two others were transferred. WARREN R. SPOFFORD has been transferred from eastern Massachusetts to the Syracuse, N. Y. area. GORDON S. BRANDES moves to Mr. Spofford's old territory from the Rocky Mountain area. EDWIN A. DANIELSON has been appointed to succeed Mr. Brandes. WILLIAM E. OLIVER, formerly a field engineer at the St. Louis office, has been appointed an abrasive engineer in the Grand Rapids, Mich., area.

H. GENE MILLER has been appointed abrasive engineer by the Bay State Abrasive Products Co., Westboro, Mass., for Minnesota and part of Wisconsin. Mr. Miller formerly was an abrasive specialist for the Bossert Co., Kansas City, Mo.

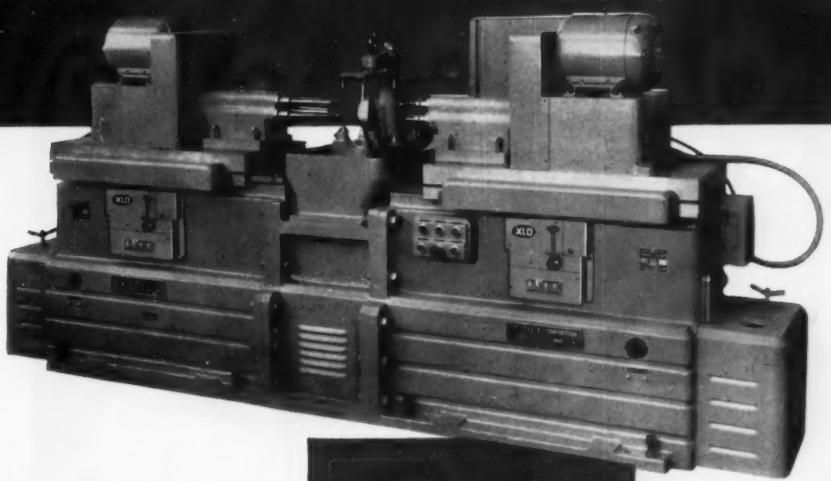
CLIFFORD R. KRAL has been named production manager of the Machine Division of the Torrington Mfg. Co., Torrington, Conn., producer of wire-forming machinery, mill machinery, and air impellers. In his new position, Mr. Kral will be responsible for all operations of the Division's manufacturing department, including estimating and production planning. He has been with Torrington since 1946.

NELCO TOOL CO., INC., Manchester, Conn. has purchased the building which houses their Berlin branch in Berlin, Conn. The company has

(*Continued on page 270*)

Modernize Today for Profits Tomorrow

WITH FAST, VERSATILE PRECISION WAY MACHINES

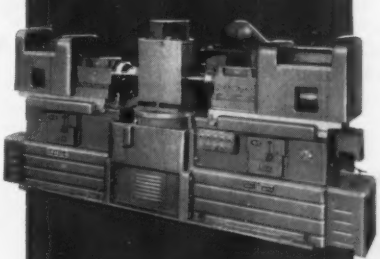


EX-CELL-O TWO-WAY: Operates from a single push-button station. Handles large, heavy work. Fixture section can be designed to accommodate the way units from any angle.

Units may be re-arranged around fixture or new fixture sections designed for different operations.

EX-CELL-O ONE-WAY: A standard way unit combined with a fixture unit to suit the work. Large, heavy, and awkward parts, loaded in the fixture, remain stationary; the spindles advance to the work.

EX-CELL-O THREE-WAY: Standard way units are electrically interlocked to operate simultaneously, or in any sequence. Fast and efficient for machining parts from three directions and holding accurate locations.



EX-CELL-O FOUR-WAY: Controlled from a central push-button station. Particularly suitable for machining parts from four directions simultaneously, and performing progressive operations.

55-50

EX-CELL-O

WAY TYPE PRECISION BORING MACHINES ARE PROFIT INSURANCE

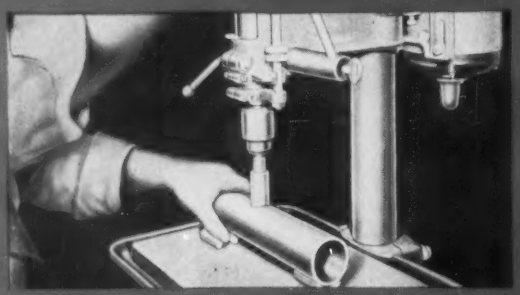
Way Machines perform such operations as precision boring, turning and facing. They consist of one or more standard way units combined with a fixture section. Each way unit has its own hydraulic system and controls to operate the spindle slide. Tooling and fixture are added to suit the individual operation. Get details from your Ex-Cell-O representative or write for Way Machine Catalog.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

XLO
EX-CELL-O for PRECISION

Starrett announces NEW SAFE-FLEX® high speed-welded edge HOLE SAWS



A typical application—cutting hole in pipe.

Illustration shows 2" hole saw and A2 arbor with ½" hexagon shank.

DOUBLE-WELDED

Shatterproof, double-welded construction — identical with the same advanced design used in Starrett SAFE-FLEX Hacksaws — makes these hole saws the safest, fastest-cutting, most durable hole saws you've ever sold. They're double welded to combine an extra tough, shatterproof body with a high speed steel cutting edge — a combination that is practically unbreakable and defies tooth stripping.

Available in a wide range of sizes from ⅝" through 4½" diameter to cut clean round holes in any machinable material including steel, brass, bronze, cast iron, aluminum, wood, plastics or sheet metal, as well as cast iron or steel pipe. Can be used with portable power tools, lathes, drill presses, radial drills, etc.

WRITE FOR BULLETIN

These new Starrett Hole Saws are an important addition to the complete line of Starrett Hacksaws, Band Saws and Band Knives. The complete line is described in new Bulletin No. 1053. Write for free copy. Address Dept. D

Showing hole saw removed from arbor.

INTERCHANGEABLE ARBORS

A wide range of saws fit four interchangeable arbors which include a ¼" high speed pilot drill. Arbors are available with ½" and ¾" hexagon or ¼" round shanks. Arbor screws into the saw cap and is locked by two drive pins which provide a positive, flexible drive. A 12" long extension is available for arbors with ½" hexagon shank.

Visit The STARRETT Exhibit
BOOTH 1116—ASTE SHOW

Starrett®

STARRETT TOOLS

"WORLD'S GREATEST TOOLMAKERS"

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS • DIAL INDICATORS • STEEL TAPES
PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information fill in page number on Inquiry Card, on page 255

AMERICAN STANDARD MACHINE PINS—4

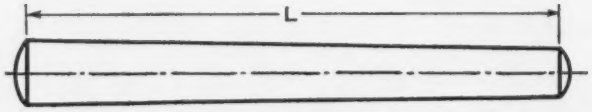


Table 4. *(Continued)* **Dimensions of Taper Pins**

Number	7/0	6/0	5/0	4/0	3/0	2/0	0	1	2	3	4	5	6	7	8	9	10
Size (Large End)	0.0625	0.0780	0.0940	0.1090	0.1250	0.1410	0.1560	0.1720	0.1930	0.2190	0.2500	0.2890	0.3410	0.4090	0.4920	0.5910	0.7060
Length, L																	
3.000	----	----	----	----	----	----	----	----	----	X	X	X	X	X	X	X	
3.250	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X	X	
3.500	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X	X	X
3.750	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X	X	X
4.000	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X	X	X
4.250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X
4.500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X
4.750	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X
5.000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X	X
5.250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X
5.500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X
5.750	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X
6.000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	X	X

All dimensions are given in inches. Standard reamers are available for pins given above the line.

Pins Nos. 11 (size 0.8600), 12 (size 1.032), 13 (size 1.241), and 14 (1.523) are special sizes—hence their lengths are special.

To find small diameter of pin, multiply the length by 0.02083 and subtract the result from the large diameter.

Types	Commercial Type	Precision Type
Sizes	7/0 to 14	7/0 to 10
Tolerance on Diameter	(+ 0.0013, — 0.0007)	(+ 0.0013, —0.0007)
Taper	1/4 In. per Ft.	1/4 In. per Ft.
Length Tolerance	(± 0.030)	(± 0.030)
Concavity Tolerance	None	0.0005 up to 1 in. long 0.001 $1^{1}/_{16}$ to 2 in. long 0.002 $2^{1}/_{16}$ and longer

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AMERICAN STANDARD MACHINE PINS—5

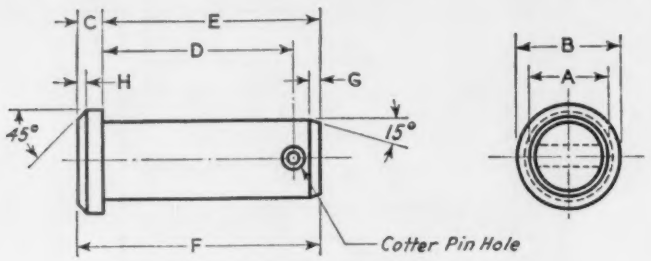

Table 5. Dimensions of Clevis Pins

Diameter of Pin A			Diameter of Head	Height of Head	Distance Under Head to Center of Hole, Min	Length of Pin Under Head	Total Length of Pin	Chamfer of Pin	Chamfer of Head	Hole Sizes
Nom	Max	Min	B	C	D	E	F	G	H	
0.188	0.186	0.181	5/16	1/16	31/64	19/32	21/32	3/64	1/64	0.0781
0.250	0.248	0.243	3/8	3/32	43/64	51/64	57/64	1/16	1/32	0.0781
0.312	0.311	0.306	7/16	3/32	13/16	31/32	1 1/16	5/64	1/32	0.1094
0.375	0.373	0.368	1/2	1/8	15/16	1 3/32	1 7/32	5/64	1/32	0.1094
0.438	0.436	0.431	9/16	5/32	1 1/16	1 15/64	1 25/64	3/32	3/64	0.1094
0.500	0.496	0.491	5/8	5/32	1 13/64	1 27/64	1 37/64	7/64	3/64	0.1406
0.625	0.621	0.616	13/16	13/64	1 15/32	1 23/32	1 59/64	9/64	1/16	0.1406
0.750	0.746	0.741	15/16	1/4	1 3/4	2 3/64	2 19/64	5/32	5/64	0.1719
0.875	0.871	0.866	1 1/16	5/16	2 1/64	2 11/32	2 21/32	3/16	3/32	0.1719
1.000	0.996	0.991	1 3/16	11/32	2 17/64	2 5/8	2 31/32	7/32	7/64	0.1719

All dimensions are given in inches.

Cotter pin holes are in accordance with accepted practice. Corners must be broken.

These pins may be supplied either soft or cyanide-hardened as specified and must be free from any defects that will affect their serviceability.

This standard was developed by the Society of Automotive Engineers in 1915 and is published in their yearly Handbook. It has been in use by the automotive industry for many years.

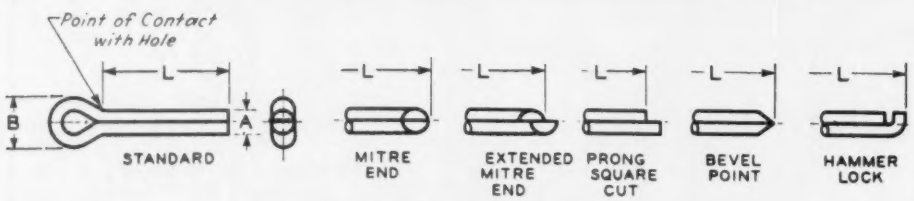

Table 6. Dimensions of Cotter Pins

Diameter Nominal	Diameter A		Outside Eye Diameter B Min.	Hole Sizes Recommended	Diameter Nominal	Diameter A		Outside Eye Diameter B Min.	Hole Sizes Recommended
	Max.	Min.				Max.	Min.		
0.031	0.032	0.028	1/16	3/64	0.219	0.207	0.202	7/16	15/64
0.047	0.048	0.044	3/32	1/16					
0.062	0.060	0.056	1/8	5/64	0.250	0.225	0.220	1/2	17/64
0.078	0.076	0.072	5/32	3/32	0.312	0.280	0.275	5/8	5/16
0.094	0.090	0.086	3/16	7/64	0.375	0.335	0.329	3/4	3/8
0.109	0.104	0.100	7/32	1/8	0.438	0.406	0.400	7/8	7/16
0.125	0.120	0.116	1/4	9/64	0.500	0.473	0.467	1	1/2
0.141	0.134	0.130	9/32	5/32	0.625	0.598	0.590	1 1/4	5/8
0.156	0.150	0.146	5/16	11/64	0.750	0.723	0.715	1 1/2	3/4
0.188	0.176	0.172	3/8	13/64	-----	----	----	------	----

All dimensions are given in inches.

A certain amount of leeway is permitted in the design of the head; however, the outside diameters given should be adhered to.

Prongs are to be parallel; ends must not be open.

Points may be blunt, bevel, extended prong, mitre, etc., and purchaser may specify type required.

Lengths should be measured as shown on the above illustration. (L Dimension)

Cotter pins must be free from burrs or any defects that will affect their serviceability.

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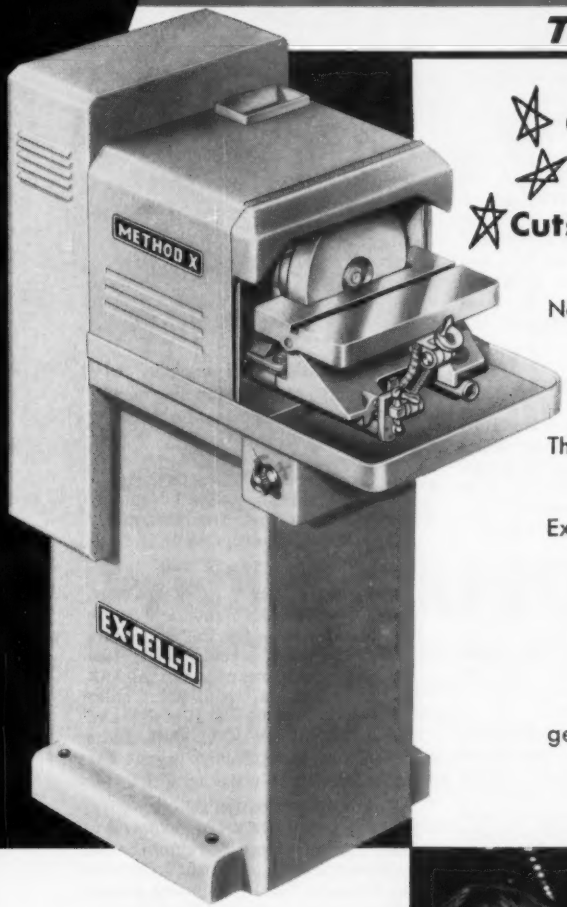
XLO
EX-CELL-O for PRECISION

Save the Cost of Diamonds with

EX-CELL-O Method X TOOL SHARPENER



Style 43 Ex-Cell-O Method X Tool Sharpener.

Popular at the Show. **At the Machine Tool Show, hundreds of men were impressed by this diamondless tool sharpener that lengthens the life of carbide tools because it leaves NO heat checks, NO grinding cracks, and NO saw-tooth Cutting edges.**

- **Cuts any conductive material**
- **Does both roughing and finishing**
- **Cuts carbides and steel at the same time!**

Now you can sharpen the hardest single-point tools without using diamonds or abrasive wheels. Using the electro-spark principal in off-hand sharpening, Ex-Cell-O Method X produces a non-directional matte finish with none of the abrasions caused by conventional grinding. The coarseness of texture and cutting speeds are controlled by an electric control switch. The "grinding wheel" is actually a 10″ cast-iron disc which is rotated by an Ex-Cell-O precision spindle with inbuilt motor. A spark gap is maintained between the disc and work piece across which current pulsations jump to do the cutting. No coolant is required in the sharpening process.

After brief instruction, men with conventional grinding experience can readily adapt their skill to Method X. Get all the facts about this new cost-saving process—get in touch with your local Ex-Cell-O representative today.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-18

added 4500 square feet of manufacturing area as well as 4 1/4 acres of industrial property for future expansion. The Berlin addition houses complete machining, heat-treating and forging facilities for the company's products.

HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., has appointed the following sales representatives: Henry Upjohn Co., 655 Lake St., Kalamazoo, Mich. for western Michigan; and C. B. KOPECKY CO., INC., State Tower Bldg., Syracuse, N. Y., for northeastern New York state.

DONALD H. DALBECK has been elected president of the Package Machinery Co., East Longmeadow, Mass., and its wholly-owned subsidiary, the Reed-Prentice Corporation, Worcester, Mass. Mr. Dalbeck will

Donald H. Dalbeck, president, Package Machinery Co. and Reed-Prentice Corporation

continue in his capacity as treasurer of both companies. ROGER L. PUTNAM, JR., controller and secretary of the parent company, assumes this position for Reed-Prentice also. J. JOSEPH KELLY, vice-president in charge of sales, was elected to the Reed-Prentice board of directors. IVER G. FREEMAN, vice-president of engineering and research, was named chairman of the Reed-Prentice management committee.

TRUMBULL COMPONENTS DEPT., General Electric Co., Plainville, Conn., has appointed JOHN A. KELLY as marketing administration specialist and JAMES E. VAN EFFEN as manager—commercial service. Mr. Kelly joined GE in 1948 as a procedures analyst. Mr. Van Effen started with the Trumbull Electric Co. in 1945.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., announces the appointment of the following manufacturer's agents: GENERAL TOOL CO., 325 N. W. 15th Ave., Portland, Oregon, for the state of Oregon; INDUSTRIAL TOOL & SUPPLY, 120 S. Euclid St., Tucson, Arizona, for the Phoenix-Tucson area; and CHARLES K. FARLEY, 52 Poplar Drive, Rochester, N. Y., for the Syracuse-Utica area. In addition the company announces the appointment of the JOSEPH MONAHAN CO., 351 Indiana Ave., N. W., Grand Rapids, Mich., to handle its line of machine tools in the Grand Rapids area.

New York and New Jersey

CARBORUNDUM CO., Niagara Falls, N. Y., announces the following three appointments of sales personnel in its Coated Abrasives Division: AUGUSTUS T. MURRAY, as sales manager for the Buffalo and Pittsburgh areas; OLIVER P. QUIST, as sales manager for the New England and New York areas; and WILLIAM J. REID, as sales manager for the midwestern district. Mr. Murray will have his headquarters at Niagara Falls. Messrs. Quist and Reid will have their headquarters at West Springfield, Mass., and Chicago, Ill., respectively.

SENECA FALLS MACHINE CO., manufacturer of lathes and automation equipment, has added the Buffalo, Rochester, and Syracuse areas to the territory covered by the Rudel Machinery Co., 100 E. 42nd St., New York. Rudel now represents Seneca Falls throughout New York state.

ALLMETAL SCREW PRODUCTS CO., INC., Garden City, N. Y., opened its new West Coast Division office in Los Angeles at 8730-36 Santa Monica Blvd. Sales activities will be under the supervision of JULIAN LEVENTHAL.

BOUND BROOK OIL-LESS BEARING CO., Bound Brook, N. J., has named HAROLD O. JOHNSON chairman of the board of directors and treasurer, WILLIAM R. TOEPLITZ president, and SAMUEL S. CONNOR vice-president and secretary. Mr. Johnson, with the company since 1921, was executive vice-president and treasurer prior to his new appointment. Mr. Toeplitz, appointed vice-president in charge of engineering in 1944, fills the vacancy created by the death of WILLIAM F. JENNINGS last September. Mr. Connor joined Bound Brook in 1945, and advanced to his new position from the post of sales manager.

ADOLPH F. LEITNER was elected executive vice-president of the Ralph C. Coxhead Corporation, Newark, N. J., manufacturers of office composing machines. Mr. Leitner will direct the operations of the company in its program of expansion and development. He was formerly vice-president and director of the Dwight Lloyd Division of McDowell Co., Inc., Cleveland, Ohio, and also served as executive vice-president of the Sintering Machinery Corporation, Netcong, N. J.

PHILIP FINALE has been appointed chief engineer of the Rolling Mill Division, Engineering Supervi-

Philip Finale, chief engineer of the Rolling Mill Division, Engineering Supervision Co.

sion Co., New York City, a subsidiary of the Birdsboro Steel Foundry & Machine Co. Mr. Finale formerly served Loewy-Hydropress in a similar capacity.

ADAMAS CARBIDE CORPORATION, Kenilworth, N. J., announces these two appointments for the sale of its line of tungsten-carbide tools, tool tips, dies, and wear parts: CLARK B. FROTHINGHAM, as district sales manager for northern Illinois; and TODD MACHINERY CO., Salt Lake City, Utah, as exclusive agent for that area.

KURT ORBAN CO., INC., Jersey City, N. J., importers of German machine tools, has appointed SUPERIOR SALES & ENGINEERING CO., 517 Morris St., Orange, N. J., its sales representative for northern New Jersey.

Ohio and Michigan

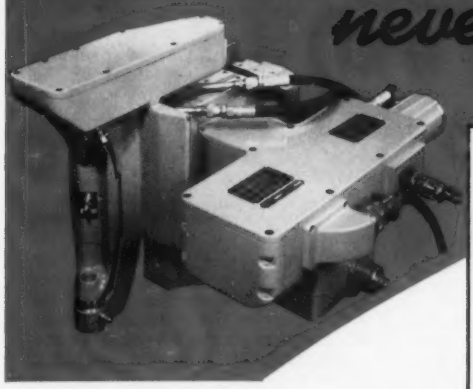
RIVETT LATHE & GRINDER, Inc., South Bend, Ind., announces the appointment of the H. A. Jones Co., 11 West Monument Ave., Dayton, Ohio, as representative in the Dayton-Cincinnati area for the Rivett line of air and hydraulic valves and cylinders and power units.

CLEVELAND CAP SCREW CO., Cleveland, Ohio, has named HENRY G. DACEY general sales manager and THOMAS A. FRIBLEY assistant general sales manager. Mr. Dacey

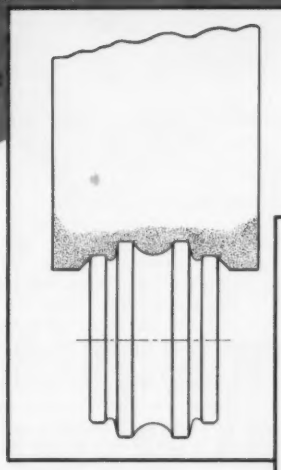
Now

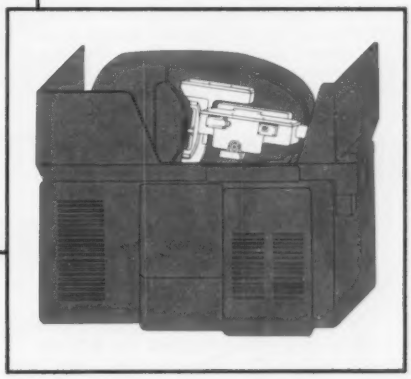
COMPLEX CONTOURS ON GRINDING WHEELS

never before possible



on Micro-Centric Grinders





with the new

HOGLUND CONTOUR WHEEL DRESSER

THE DRESSER WITH ENLARGED SYNCHRONIZED TEMPLATES

20 MILLIONTHS ACCURACY in forming ball race grooves, single or multiple—besides generating complex oil seals to accuracy of tenths in **ONE SINGLE AUTOMATIC OPERATION** with only the size and shape of the diamond as a limiting factor.

MODEL 81 uses a pair of enlarged synchronized cams to control the diamond movements.

An accurate swinging yoke insures super accurate radii in the ball race groove.

DIAMONDS travel at **UNIFORM** peripheral speed over the whole contour.

Here is perfect contour grinding accuracy through correct dressing of abrasive wheels, the Hoglund way of practically eliminating skill in production grinding.

AT THE A.S.T.E. SHOW — See us at Booth 205

Check these features of HOGLUND *Wheel* DRESSERS

Precision

Automaticity

Will dress any angle on the grinding wheel, perpendicular as well as horizontal.

Not limited to shallow angles and profiles but will dress any angle up to perpendicular to the grinding spindle (can even undercut grinding wheels, if necessary).

Eliminates necessity of skill in contour grinding.

Set up time negligible. No skill required.

Diamonds optically set in Microscope. No adjustment required on machine when changing diamonds, so repetition within a tenth is possible.

Uniform peripheral dressing speed of diamond.

HOGLUND FOR ACCURACY

HOGLUND

ENGINEERING & MANUFACTURING CO.

345 Snyder Ave., Berkley Heights, N. J.

joined the company in 1948. Mr. Fribley has been with the organization since 1953.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, Ohio, announces these appointments: EDWARD E. HELM, sales vice-president since 1946, has been made vice-president and general manager. CHARLES R. SUTHERLAND, assistant chief engineer, is now controller. RICHARD A. GEUDER is the new general sales manager moving up from assistant general sales manager. EARL C. BARNES, most recently manager of engineering for Ashtabula Products, assumes the position of assistant chief engineer.

WALTER W. THORYK has been appointed carbide metals representative in Ohio and western Pennsylvania for Wesson Metal Corporation, Lexington, Ky. He will make his headquarters at 1597 Roselawn Road, Mayfield Heights, Ohio.

HARRY L. SCHULTZ has joined the Warco press sales engineering department of the Federal Machine & Welder Co., Warren, Ohio. He has been associated with the design and manufacture of presses for the past twenty years.

ALFRED F. BAUER has been appointed assistant general manger of the Doehler-Jarvis Division of National Lead Co., Toledo, Ohio. Formerly chief engineer of the company, Mr. Bauer will continue to function in that capactiy.

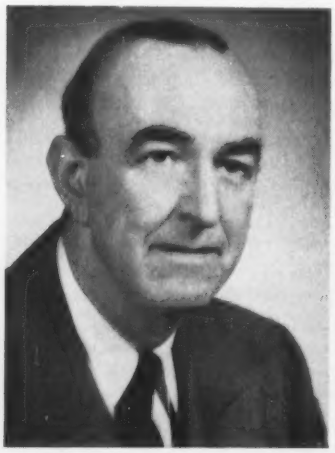
Dr. JAMES C. HODGE joins the Warner & Swasey Co., Cleveland, Ohio, as a vice-president. He will be concerned, for the present, with problems of manufacture at the Cleveland; New Philadelphia, Ohio; and Lansing, Mich., plants. Dr. Hodge formerly was president of the Wellman Engineering Co.

Paul W. Polk, new executive vice-president, Sheffield Corporation.

SHEFFIELD CORPORATION, Dayton, Ohio, has appointed PAUL W. POLK executive vice-president. Mr. Polk has been president of the company's subsidiary, the Threadwell Tap & Die Co., since 1954. Sheffield also announces the purchase of ERWIN A. SLATE, INC., Gasport, N. Y., a machine-tool sales and service engineering company. The Slate company will function as a wholly-owned subsidiary, and will be Sheffield's operating agency in the upper New York State area.

MAXWELL Co., formerly of Bedford, Ohio, announces its removal to Highland Road, Macedonia, Ohio.

GEORGE PERRAULT, JR., manager of the Salem, Ohio, Rolling Mill Division of the E. W. Bliss Co., Canton, Ohio, was appointed a vice-president of the company. Mr. Perrault previously was manager of the Division.



Dr. James C. Hodge, vice-president, Warner & Swasey Co.

George Perrault, Jr., vice-president, E. W. Bliss Co.

WESSON Co., Detroit, Mich., announces two field service engineering appointments and an addition to its research and development staff. ROBERT HUNT, associated with Wesson for several years as a field engineer in Detroit, has been appointed to the company's research and development staff. JOSEPH S. GEISINGER, field engineer on tool and carbide machining applications in the Detroit area, has been transferred to the Cleveland field engineering staff. Concurrently, H. J. DUPUIS, formerly with Desoto Division of Chrysler Corporation, was appointed to the Detroit field engineering staff to work on machining applications in the automotive industry.

VINCENT T. KEPLER has been named to the new position of supervisor of the application development section for the Carmet Division, cemented-carbide producing facility of the Allegheny Ludlum Steel Corporation, at Ferndale, Mich. He will supervise the work of a group of engineers on the development and application of cemented carbides. Prior to joining Allegheny Ludlum in 1952, Mr. Kepler was associated with the carbide industry for a number of years.

METAL CARBIDES CORPORATION, Youngstown, Ohio, announces the following additions to the Detroit, Mich. sales office: MR. BUTLER BREWEN, district sales manager, formerly associated with Sandvik Steel Co. and Vascaloy-Ramet Corporation; and MR. DONALD COATS, formerly associated with the Carboloy Co., who will serve as sales representative.

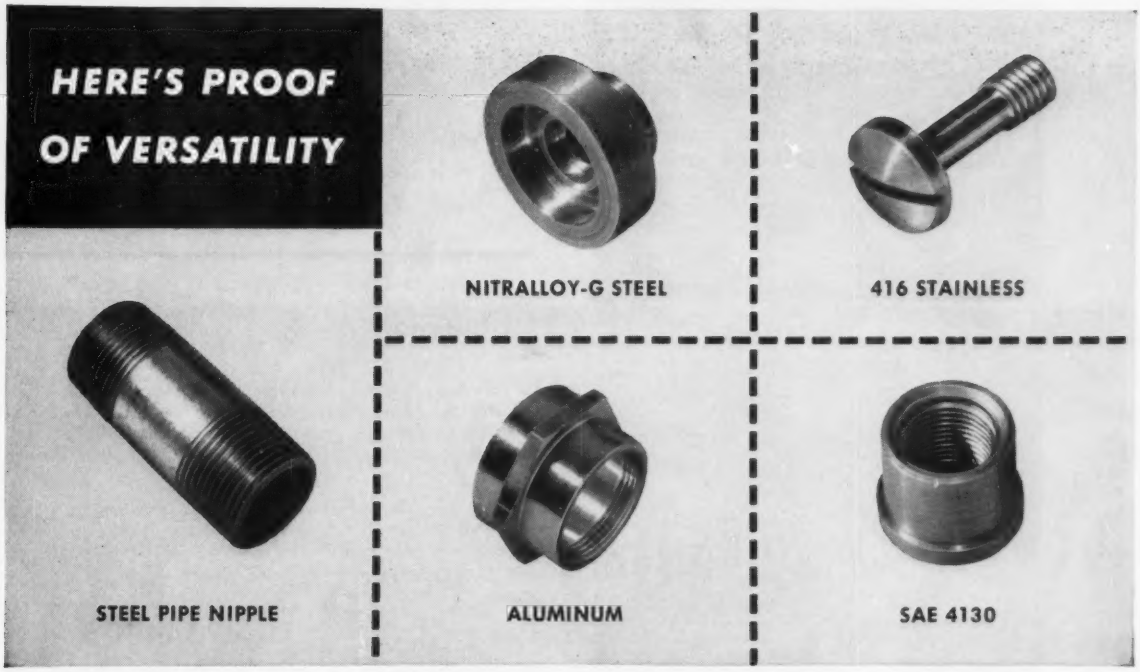
WILLIAM T. WILBUR has been appointed chief application engineer of the Progressi Welder Sales Co., Detroit, Mich. Mr. Wilbur brings to his new position over sixteen years of experience in designing complete resistance welding systems for large users.

ROBERT L. COLLINS has been appointed manufacturing manager of the Special Products Division, Ford Motor Co., Dearborn, Mich. He joined the Ford Division in 1949.

THOMAS J. FELL, office manager for Kennametal Inc. in Detroit, Mich., has been appointed assistant superintendent of the company's Detroit plant. He is being succeeded by ROBERT J. RODDY, who has been a company sales representative.

GUY H. PITTS has been made manager of the Fabrication Division, Bohn Aluminum & Brass Corporation, Detroit, Mich. His new duties will entail supervision of manufacturing operations in six plants in Michigan and Indiana.

(This section continued on page 276)



SUN DEVELOPS VERSATILE NEW CUTTING OIL FOR SCREW MACHINES AND JOB SHOPS

New cutting oil, Sunicut 5534, is moderately priced... gives excellent machining results on wide range of steels

New Sunicut 5534 is a non-emulsifying, transparent cutting oil specially compounded to give above-average machining results to operators who want a single oil to machine a large variety of ferrous metals.

Tests have proved that new Sunicut 5534 meets this demand for an all-purpose cutting oil. It is ideal for general screw machine and turret lathe work. It is also excellent for tapping, drilling, threading, and light stamping operations. In addition, new Sunicut 5534 can be used on many special machining jobs, both high and low speed, with metals ranging from B1112 to 4130 as well as free-machining stainless steels.

For complete information about new Sunicut 5534 and how it can help you reduce your oil inventories... lower your production costs... see your Sun representative. Or write SUN OIL COMPANY, Phila. 3, Pa., Dept. M-3.

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INDUSTRIAL PRODUCTS DEPARTMENT

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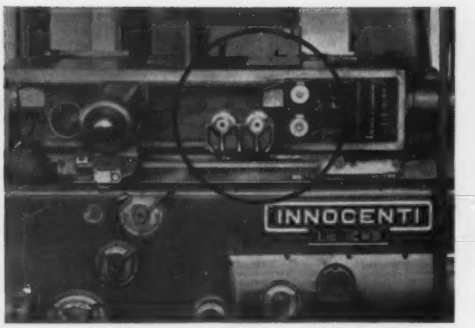

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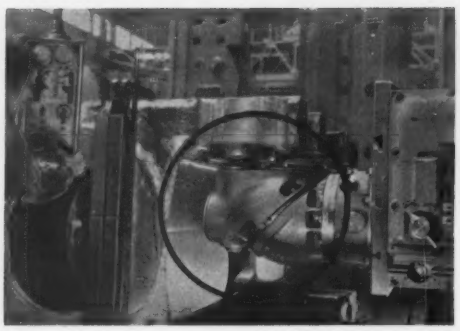

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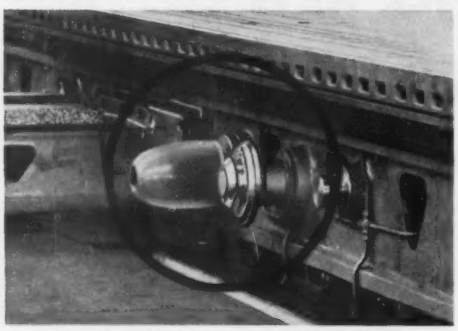

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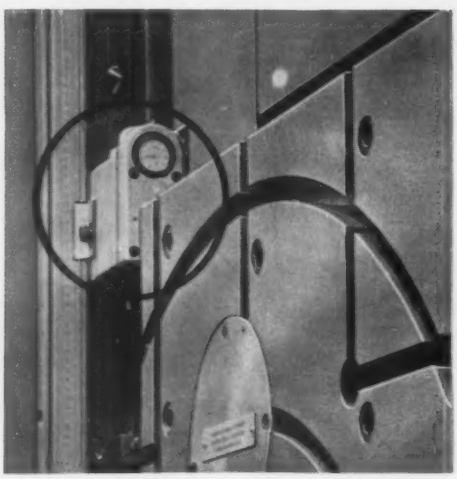

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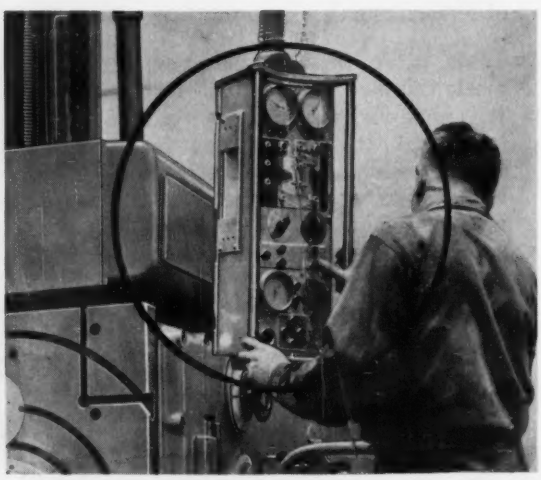

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48

for instance

1. Patented suspension of the spindle carrying headstock, allowing automatic adjustable compensation of the deflection of spindle axis during feeding, according to the importance of the machining heads utilized.

2. Front face of the machined headstock, provided with slots - patented design - for fixing various milling heads (right angle heads, or any other angle) allowing surfacing operations through feeding movement of the headstock.

3. Patented motors with stepless range of speed, allowing the exact choice of cutting speed and feed for a determined machining operation, as well as a constant maximum operating efficiency.

4. Patented automatic cycles for high precision positioning of feeding movements.

5. Patented pendant control box allowing selection of speeds and feeds at any working position of the operator (this position being adjustable at 340° rotation over an operating range of 12 feet or more round the machine, at any height).
Start, stop, feed reverse, deceleration and selection of spindle speeds.
Start, stop, feed reverse, acceleration, deceleration and selection of spindle feeds, separate or simultaneous on two feeding movements.
Locking of all movements after selection and adjustment.
Adjustment and spindle positioning.
General stop button.

PATENTS

protect this machine all over the world

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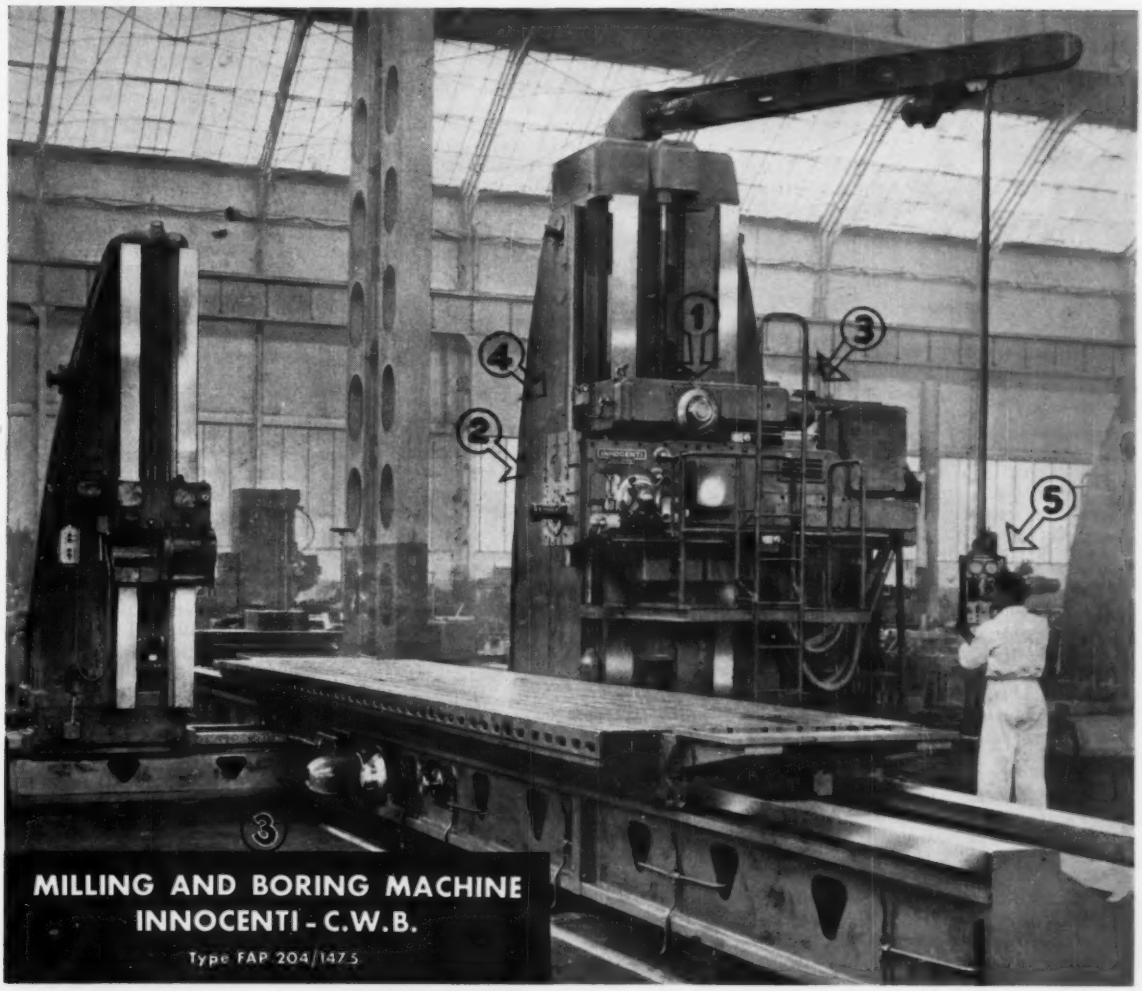

MILLING AND BORING MACHINE
INNOCENTI - C.W.B.
Type FAP 204/147.5

the design of this machine and its versatility are such that a saving of 50% to 80% in the machining times can usually be made over conventional machines.

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SOC GENERALE PER L'INDUSTRIA METALLURGICA E MECCANICA

MILAN **NEW YORK** **PARIS**

Information and literature from: Innocenti Corporation, 43 West, 61st Street, New York 23, N.Y.

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CHARLES R. DELORME and CARL F. JOHNSON have been appointed sales engineers for the Colonial Broach & Machine Co., Detroit, Mich. Messrs. DeLorme and Johnson will service major automotive accounts in the Detroit territory.

WILLIAM L. BAKER has been appointed sales engineer of Whitman & Barnes, Plymouth, Mich. He will service customers and distributors in eastern Maryland, Virginia, Washington, D. C., and southern Delaware.

FIRTH STERLING, INC., producer of high-speed steels, will be represented in the Detroit market by ALLOY STEELS, INC., 7055 Intervale Ave., Detroit, Mich.

M. J. TAUP was appointed administrative assistant to the vice-president of sales of Vickers Incorporated, Detroit, Mich.

Pennsylvania

DELTA POWER TOOL DIVISION, Rockwell Mfg. Co., Pittsburgh, Pa., announces the creation of a new specialty sales department and the promotion of three key sales individuals. GEORGE E. ROCKWELL becomes sales manager—specialty products. THOMAS C. MORTIMER, southern regional sales manager, assumes Mr. Rockwell's former duties as eastern regional sales manager; and WARREN B. SHERMAN, district sales manager for Texas and Louisiana, is the new southern regional manager.

VULCAN CRUCIBLE STEEL CO. Division, H. K. Porter Co., Inc., Aliquippa, Pa., has appointed two new distributors in the New York metropolitan and New Jersey areas. These are: GRAMMER, DEMPSEY & HUDSON, INC., 212 Rome St., Newark 5, N. J., and PASSAIC COUNTY STEEL SERVICE, INC., 21 N. First St., Paterson 2, N. J. Both distributors will stock Vulcan tool steels and offer technical service regarding application and use.

E. F. HOUGHTON & CO., Philadelphia, Pa., has named SIDNEY J. BARBER manager of its metal-working products department. He was formerly supervisor of metal-working research for the company. In his new position, Mr. Barber succeeds JAMES MCELGIN, who died suddenly on December 7, 1955. CLAUDE G. WALL, a member of the laboratory staff for thirteen years, was made the new supervisor of metal-working research.

C. D. KING has been appointed assistant to the executive vice-president—operations of the United States Steel Corporation, Pittsburgh, Pa. Previous to his appointment, he was general chairman of the company's operating committees concerned with the development of advanced procedures. Mr. King joined United States Steel in 1914 as a metallurgist.

JOHN PORTER was appointed sales representative for Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., with headquarters at the company's New York City office. Mr. Porter will serve the New England states. MR. A. F. MOORE, who formerly served this territory will concentrate his activities in the New York and northern New Jersey area.

HELI-COIL CORPORATION, Danbury, Conn., announces the purchase of the entire manufacturing facilities of the Towle & Son Co., Conshohocken, Pa. Heli-Coil will move all Towle equipment to Danbury in the near future and combine the facilities of both organizations with Towle as a division of the Heli-Coil Corporation.

SELAS CORPORATION OF AMERICA has moved to a new plant in Dresher, Pa., a Philadelphia suburb. All activity is now concentrated in a modern building on an 11-acre site.

L. B. KUHNS and B. J. FLETCHER have been named assistant chief engineers for Aluminum Co. of America, Pittsburgh, Pa. Both men will continue in their present positions, Mr. Kuhns as chief construction engineer, and Mr. Fletcher as chief hydraulic engineer.

HEPPENSTALL CO., Pittsburgh, Pa., has purchased the assets of the Midvale Co., and has formed as a wholly-owned subsidiary the Midvale-Heppenstall Co. Products of the new company include forgings, ingots, rolls, and pressure vessels.

LOUIS W. JANDER has been named general sales manager of the Henry Disston Division, H. K. Porter Co., Inc., Philadelphia, Pa. Mr. Jander succeeds WALTER H. GEBHART, who will serve as a consultant.

JOHN E. NEWLIN, JR., has been appointed manager of tool steel sales by the Carpenter Steel Co., Reading, Pa. Mr. Newlin, previously with Henry Disston & Sons Co., Inc., succeeds NORMAN W. CALKINS.

JOHN W. BREITMAYER has been appointed sales manager of the Hallowell Collar Division of Standard Pressed Steel Co., Jenkintown, Pa. He succeeds ALFRED H. KLEPFER who retired.

FRED E. SOLYMOS has been appointed vice-president and general sales manager of the Colonial Metals Co., Columbia, Pa., manufacturer of non-ferrous metal ingots.

Coming Events

MARCH 19-23—Industrial Exposition sponsored by the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at the International Amphitheatre, Chicago, Ill. For further information write to Harry Conrad, executive secretary, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

APRIL 4-6—Eleventh Annual Meeting and Exhibit of the SOCIETY OF LUBRICATION ENGINEERS at the William Penn Hotel, Pittsburgh, Pa. Complete program and registration information can be obtained from the Administrative Secretary, American Society of Lubrication Engineers, 84 E. Randolph St., Chicago, Ill.

APRIL 10-12—Twelfth annual meeting of the Metal Powder Association and 1956 METAL POWDER SHOW in Cleveland, Ohio, with headquarters at the Hotel Cleveland. Additional information can be obtained from the Metal Powder Association, 420 Lexington Ave., New York 17, N. Y.

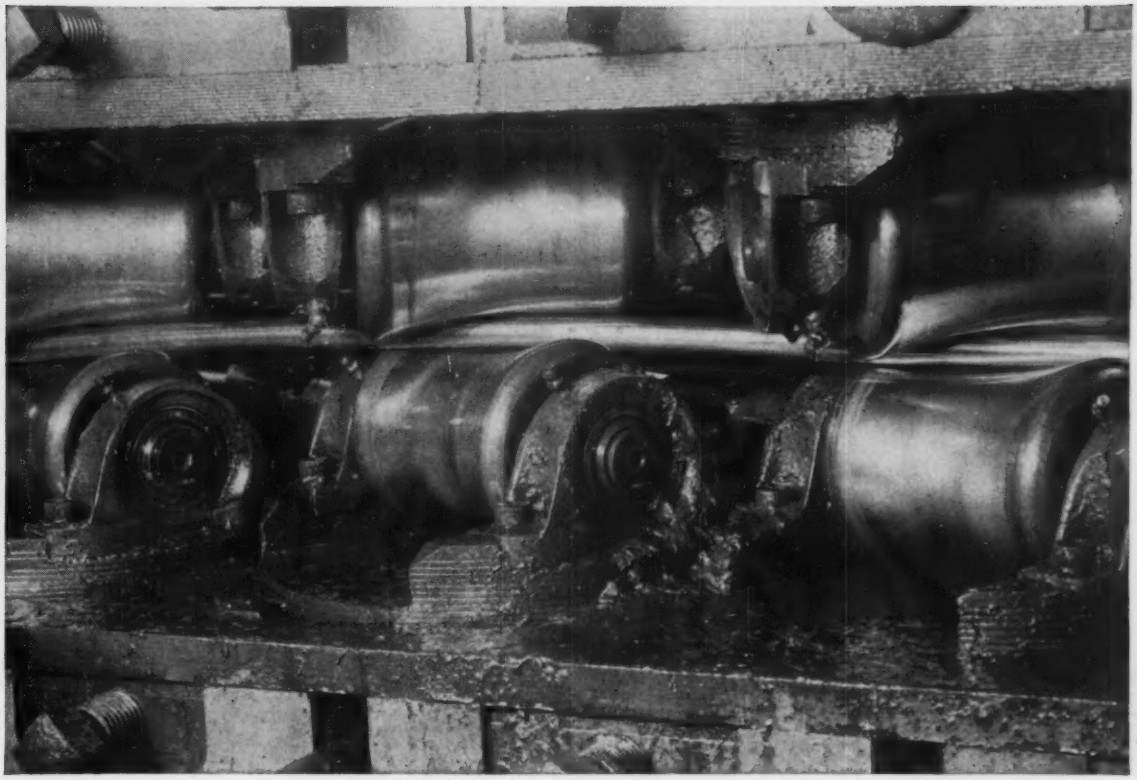
MAY 9-11—National Spring Technical Meeting and Welding and Allied Industry Fourth Exhibition of the AMERICAN WELDING SOCIETY will be held at Memorial Auditorium, Buffalo, N. Y. For further information write to the American Welding Society, Inc., 33 W. 39th St., New York 18, N. Y.

MAY 14-17—First Design Engineering Show will be held at Convention Hall, Philadelphia, Pa. For further information write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 14-17—AMERICAN SOCIETY OF MECHANICAL ENGINEERS sponsors a conference to study industry's problems in design engineering. It will be held at Convention Hall, Philadelphia, concurrently with the First Design Engineering Show. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

May 17-19—NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—Thirtieth Engineering Industries Exposition in conjunction with its Annual Convention at the Statler Hotel in New York City. For further information, write to Harold Becher, chairman of publicity, New York State Society of Professional Engineers, 1941 Grand Central Terminal, New York 17, N. Y.

MAY 17-19—Engineering Industries Exposition, Statler Hotel, New York City. The Consolidated Edison Co. will exhibit a scale model of the reactor which it is constructing at Peekskill, N. Y.



Uses tool steel that outwears others 3 to 1 for its straightener rolls

TO help its customers get the longest possible life out of the rolls used in its small tube straighteners, Mackintosh-Hemphill Division of E. W. Bliss Co. makes them from Graph-Mo® steel.

Graph-Mo contains millions of tiny particles of diamond-hard carbides. As a result, users report it outwears other tool steels on an average of three to one!

Graph-Mo steel also contains free graphite which gives it outstanding anti-friction properties, prevents pick up and scoring. This is a big advantage to users of small Mack-Hemp straighteners because it results in a better surface on the products being processed. What's more it eliminates chrome plating the rolls, which is usually necessary when the straighteners are used for non-ferrous metals such as brass.

Graph-Mo steel gives Mackintosh-Hemphill two other important manufacturing advantages. It saves machining time because it's 30% easier to machine than ordinary tool steels. And it simplifies heat treating because of its uniform response to heat treatment.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you want more information about their use in dies, punches, gages and machine parts, write for the new Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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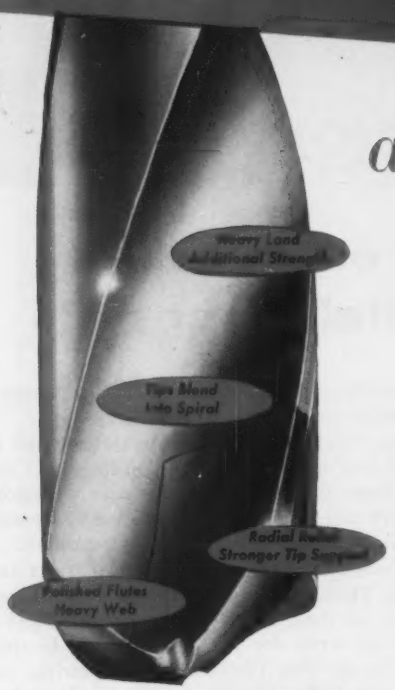
here's the Super carbide drill for your job



any quantity .... any style

As the biggest producer of carbide drills, we are able to offer a specific type for every carbide drilling application.

Exclusive features incorporated in these drills give greater tool life, faster cutting at lower cost.

High volume production facilities make tools available from stock.

Standards stocked in fractional, wire and letter sizes, in solid and tipped carbide; types for hardened steels, cast iron, aluminum, magnesium, plastics and abrasive substances.

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Send now for our complete 92-page catalog just off the press!

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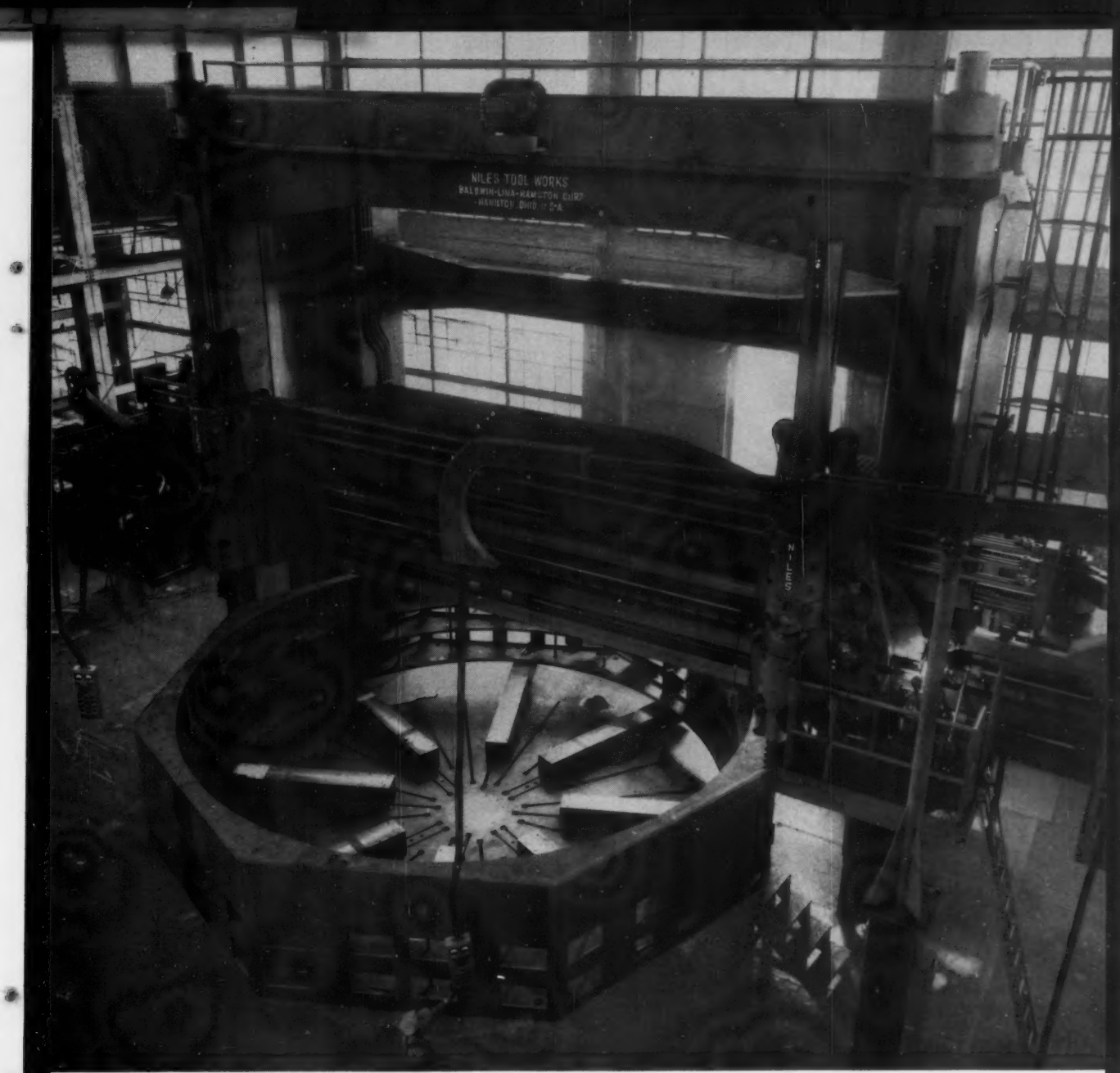

35-year performance payoff

sells Elliott new Niles 30-ft. boring mill

The remarkable performance since 1920 of a Niles 20-ft. vertical boring mill was responsible for Elliott Company's selection of a new, modern Niles 30-ft. mill. Installed primarily for machining blowers, turbines and condensers built at their Jeannette, Pa. plant, and large generator stator frames for their Ridgway Division, this large vertical boring mill is also available for outside contract work.

The new Niles has a 16-ft. clearance under the crossrail. It's equipped with two 9-ft. travel rams and a 19-ft. 6-in. table. Other features include electronic feed control and electrically operated clamps which minimize set-up time and hold settings rigidly accurate. Special counter weights on the rams take up backlash in the feed gears at all times. This insures maintaining dimensional tolerances within .001 and .002 across large surfaces.

Elliott also expects to use such other features as compound feeding and 60° swing of the boring rams to install electronic-hydraulic duplicating equipment on the mill. This will enable them to do contour or profiling work, thus increasing the machine's versatility and adaptability for a wide variety of work.

You too will find that the many exclusive features of Niles machine tools add up to greater production and higher quality. For further details write today. Hamilton Division, BLH Corporation, Hamilton, Ohio.

HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON

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the ONE COMPLETE Tool Line

BLOCK-TYPE GENERAL PURPOSE BARS
PRECISION LINE BORING BARS
SUPER MICROMETER ADJUSTABLE FLYCUTTER TOOLS
SUPER MICROMETER ADJUSTABLE TOOLS WITH UNFINISHED SHANKS
L-TYPE MICROMETER EXPANSION BORING TOOLS
CLAMPED-ON CARBIDE TIP PLANER TOOLS
DAVIS
INTERCHANGEABLE BLOCK-TYPE TOOLING
MICROMETER EXTENSION AND THREE-AND-ONE BORING HEADS
"TAP-SAVER" TAPPING HEAD
QUICK-CHANGE AND MORSE TAPER ARBORS AND SLEEVES
SUPER MICROMETER ADJUSTABLE STUB BORING TOOL SETS

Yes, one look at Davis and you're sure to agree that here is industry's most complete standard tool line. One quick check of its unparalleled range of types, sizes and cutter materials will convince you that only Davis offers the full advantages of one-source buying for all your boring, turning and planing requirements.

Here, too, at Davis you'll see designs from the one engineering group with the vision and background of metal working experience to produce special tooling of outstanding efficiency. So whatever your needs . . . at the show and in the shop . . . it's always good advice to see Davis first for the best in tooling.

DAVIS

BORING TOOL DIVISION OF
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Fond du Lac, Wisconsin

Booth 489 CHICAGO'S INTERNATIONAL AMPITHEATRE

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

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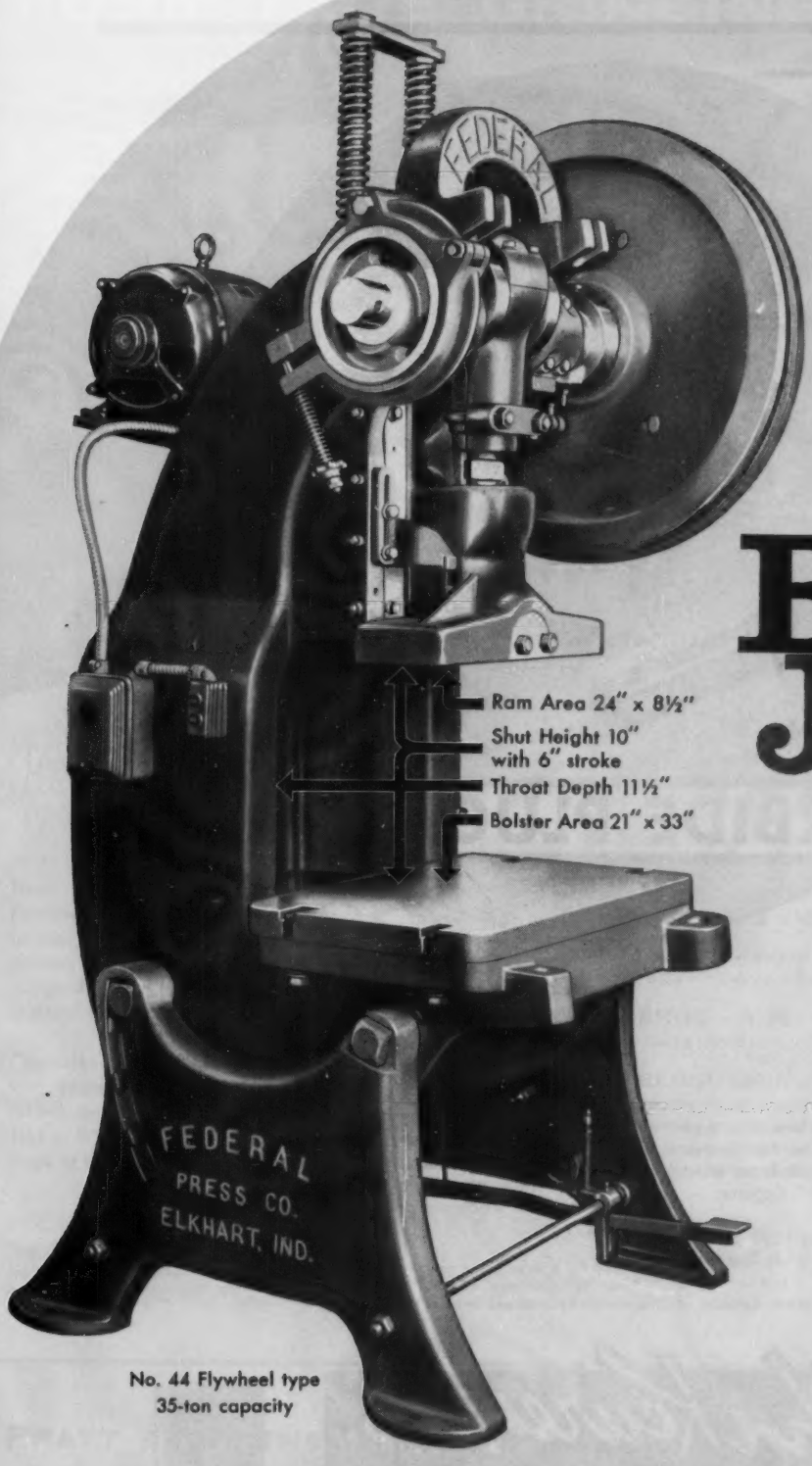


No. 44 Flywheel type
35-ton capacity

For economical handling of....

BIG JOBS

You can't beat the FEDERAL #33 and #44 with "oversize" dimensions

Don't let light, bulky work tie up your big, costly equipment. These FEDERAL PRESSES are expressly designed to handle cumbersome jobs—such as die-cast trimming, laminations, progressive die work. *Just note the generous dimensions!* The #33 and #44 also give you *extra quality* features—plus quality materials and workmanship that have made FEDERALS famous. Available in geared or flywheel types with or without air clutch and electro-pneumatic controls for high-speed operation. WRITE FOR NEW CATALOG showing complete line.

No. 33 Press—26-ton—with following important dimensions: Ram Area: 18" x 7½" • Shut Height: 9½" with 2½" stroke • Throat Depth: 8¾" • Bolster Area: 16" x 32".

FEDERAL PRESS COMPANY, 601 Division Street, Elkhart, Indiana

FEDERAL *Open-back Inclinable* PRESSES

31 YEARS OF QUALITY CONSTRUCTION

If WEAR *is a factor...*

...use VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016″ to .500″ diameter

CHROME CARBIDE
taper insert type .500″ to 1.510″ diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016″ to .500″ diameter, The Van Keuren Company now offers a new line of chrome carbide taper insert plug gages in the range from .500″ to 1.510″ diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new chrome carbide taper inserts (Carboloy, grade #608*) promise to be equally effective. Wearing qualities of chrome carbide are comparable with tungsten carbide. In addition, the material is lighter than tungsten carbide and has a coefficient of expansion close to that of steel . . . both of which factors are a distinct advantage in the larger sizes.

Finish on Van Keuren gages in either tungsten carbide or chrome carbide will average .5 RMS or better. These gages are available in Class Y, X and XX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the new 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

* Trademark of the Carboloy Dept. of General Electric Company.

VK

37th YEAR

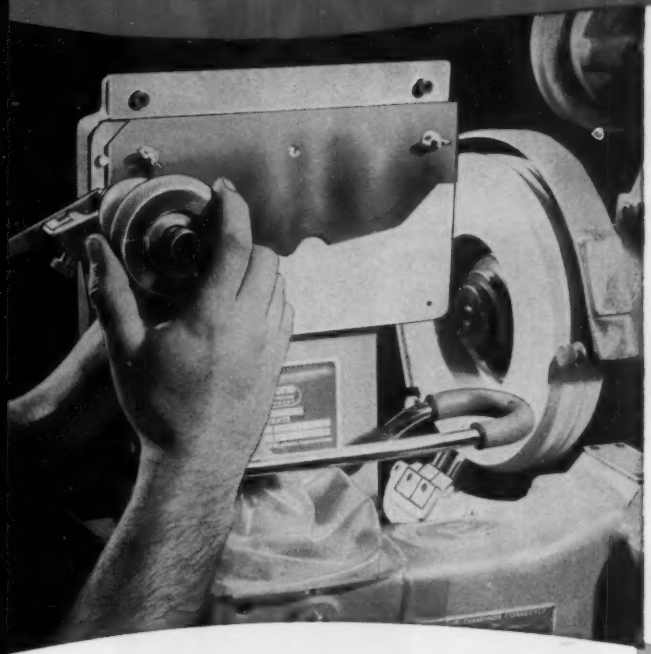
THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

For more information fill in page number on Inquiry Card, on page 255

FORM-TRUE GRINDING WHEELS



with

PRATT & WHITNEY

Diaform

WHEEL FORMING ATTACHMENTS

FORM COMPLEX PROFILES
TO "TENTHS" ACCURACY
... in minutes

there's a Diaform RIGHT for Your work!

Team up a lightweight, portable P&W DIAFORM Wheel Forming Attachment with your horizontal spindle surface grinder and true those complex grinding wheel shapes in minutes . . . re-truing the same shapes as often as required . . . produce ***better*** dies, punches, forming tools etc. ***in hours instead of days!***

Operation . . . based on the pantograph principle . . . is very simple, requires no special skill. A tracer is lightly traversed over an inexpensive template; reduction ratios of 10:1 or 5:1 minimize template errors and the form is diamond-trued at the wheel to tenths of a thousandth accuracy.

- **SMALL** – **MODELS AT and BT**
  for truing wheels up to 10" diameter and 1" wide.
- **MEDIUM** – **MODELS 2A and 2B**
  for truing wheels up to 14" diameter and 2" wide.
- **LARGE** – **MODELS 4A and 4B**
  for truing wheels up to 20" diameter and 3" wide.
- **RELIEF GRINDING** – **SERIES "R"**
  eliminates lengthy calculations and trial-and-error methods . . . accurately compensates for rake or relief angles on form cutting tools and provides true form at the cutting edge. Three models accommodate wheels up to 20" diameter and 3" width.

PRATT & WHITNEY FACTORY-DIRECT SERVICE

The Pratt & Whitney Representative who calls on you is a Specialist in his line. He's fully qualified by training in our factory and by long experience to bring you the expert application engineering service essential to full productive efficiency.

SEE THE DIAFORM IN OPERATION AT THE
INDUSTRIAL DIAMOND ASSOCIATION OF AMERICA
BOOTH NO. 520
A.S.T.E. SHOW

PRATT & WHITNEY COMPANY
INCORPORATED
16 CHARTER OAK BLVD., WEST HARTFORD, CONN.

Branch Offices . . . BIRMINGHAM • BOSTON • CHICAGO CINCINNATI • CLEVELAND • DALLAS (Southwest Industrial Sales Co.) DETROIT • HOUSTON (Tri-Tex Machine & Tool Co.) • LOS ANGELES NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS . . . Export Dept., WEST HARTFORD
MACHINE TOOLS • CUTTING TOOLS • GAGES

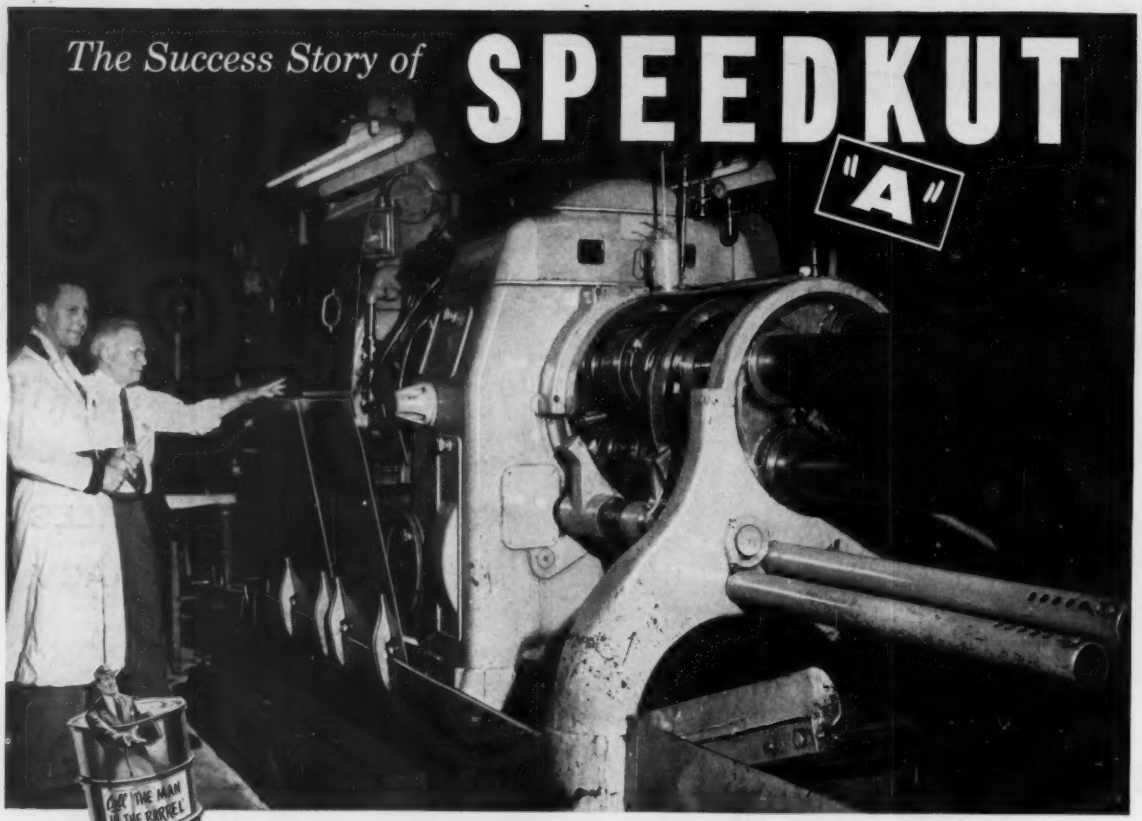
PRATT & WHITNEY COMPANY, INCORPORATED
12 CHARTER OAK BLVD., WEST HARTFORD 1, CONN.

Please mail my free copies of:

- ☐ Bulletin No. 543-2, Diaform Models AT and BT.
- ☐ Bulletin No. 572-1, Diaform Models 2A and 2B.
- ☐ Bulletin No. 548-1, Diaform Models 4A and 4B.
- ☐ Bulletin No. 574, Series "R" Diaform.

NAME_____
POSITION_____
COMPANY_____
CO. ADDRESS_____
CITY_____ ZONE_____ STATE_____

The Success Story of **SPEEDKUT "A"**



. . . a boost for screw machine output!

The Success of SpeedKut A . . . is an oft repeated story of increased output, better tool life and less downtime. For SpeedKut A is one of Stuart Oil Company's balanced, general purpose cutting oils specifically designed for high speed machining of free-machining screw stock and brass on single spindle and multiple spindle automatic screw machines, turret lathes, milling machines, and hobbing machines.

SpeedKut A is a product of Stuart's sulphochlorination processing that provides absolute uniformity and stability. Highly effective chemical additive materials are pre-balanced under strict laboratory supervision to instill SpeedKut A with the anti-weld and friction reducing characteristics necessary to the range of machining operations for which it is recommended.

When selecting a cutting fluid, factors to be considered are material being machined, material hardness, speeds, feeds, depth of cut and machine design. Cullman Wheel Company, Chicago, Ill., a leading sprocket manufacturer, took all these factors into consideration more than 10 years ago. They chose SpeedKut A then and still use it for their multi-spindle automatics to cut sprocket blanks from free machining bar stock and for hobbing the sprocket teeth.

Your operation may be another link in this success story of SpeedKut A . . . or perhaps the factors that must be considered indicate a different type of balanced cutting fluid. "The Man in the Barrel", your Stuart Representative, will help you take all of the factors into consideration. Consult him. You'll be happy you did.

Write for Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder. It's a quick guide to starting recommendations for any job. Your name and title on a company letterhead is all that's needed.

D. A. STUART OIL CO. LTD.
2739 S. Troy St., Chicago 23, Ill.

More than a "Coolant" is Needed

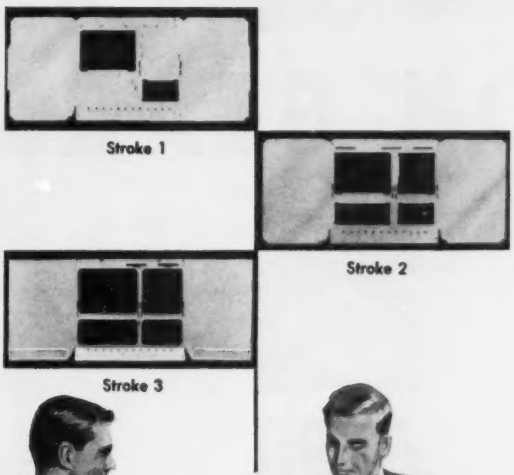
Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

1-2-3 STROKES OF A CLEARING TRANSFER FEED PRESS PRODUCE FRONT AND SIDES OF GENERAL ELECTRIC KITCHEN RANGES

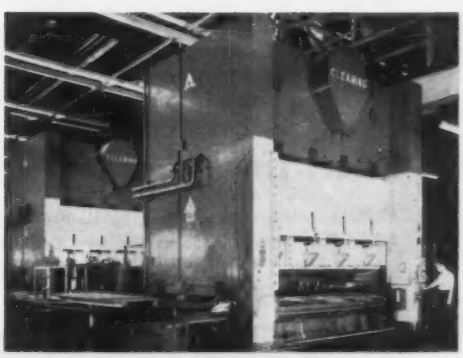


Productive Efficiency? When you tool up with a Clearing transfer feed like the one shown here in General Electric's Louisville plant, the big jobs become easy. Blanks over seven feet long are automatically fed into this Clearing; three successive strokes and the front and two sides of an electric range come out the other end. Oven and drawer openings, hinge slots and corner notches are completed and base is formed on this giant 850 ton automatic press.

This is the kind of manufacturing know how that can put a finished range with all of its durability and sales tempting beauty within easy reach of the family budget.

If you want to tool up for speedier and more automatic production call in a Clearing man to talk about what a Clearing transfer feed can do in your operation. Get in touch with Clearing today.

By the way, Clearing has a new 16mm movie about a transfer feed press. Why not ask about it?



Can a transfer feed press like this Clearing lead to more profitable production for you?

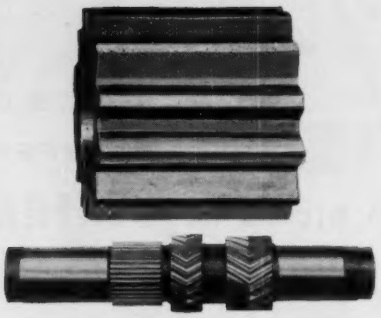
Write for Clearing booklet "Thinking about a better way to do the job?"

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *Division of U. S. INDUSTRIES, Inc.*

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio

For more information fill in page number on Inquiry Card, on page 235



8 PRECISION GEARS

...all generated on a single Farrel-Sykes machine

Those eight gears should give you some idea of the versatility of a Farrel-Sykes "Twin-Head" generator.

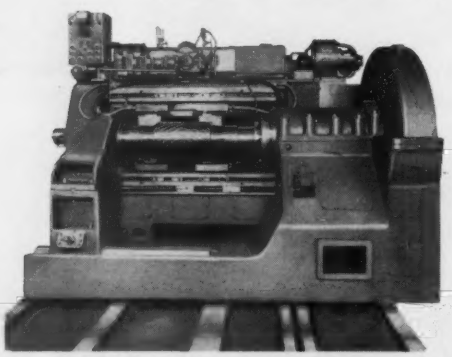
The gear machine is made with the work axis horizontal, the position in which the gears themselves run. This permits a wide variety of work to be handled on a single generator—controls the work positively, too.

Built with high initial precision, "Twin-Head" generators are provided with means of compensating for wear and sustaining accuracy for thousands of operating-hours. Other important benefits are faster cutting speed, reduced setup time, and ease of operation.

Write for details of this versatile gear generator, today.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

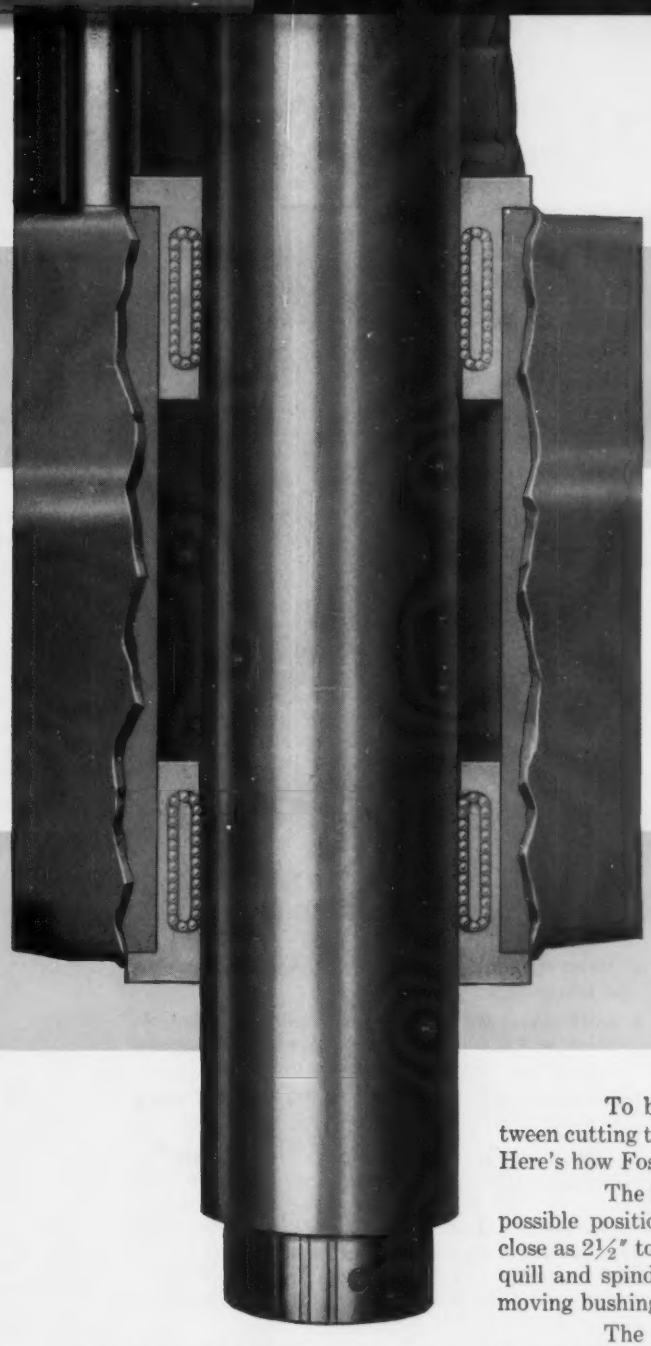


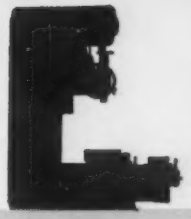
Types of gears illustrated (from top to bottom): spur • gear component with integral shaft • continuous-tooth herringbone • single helical • double helical with staggered teeth • double helical, staggered-tooth, with center groove • herringbone rack and pinion • cluster.

Farrel-Birmingham ®

FB-1032

For more information fill in page number on Inquiry Card, on page 255





NEW QUILL BEARING DESIGN helps achieve extreme precision in Fosmatic Jig Borer

Eight models available from the low-cost Model 30 with 36" x 18" table, to the virtually automatic model 54P with 54" x 22" table. Other important features: Automatic Positioning, choice of two precision measuring systems, milling feed, rapid traverse to quill, power clamping of table and saddle, coolant system and reversing motor control for tapping.

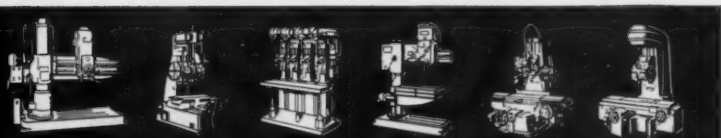
To bore with precision as close as ±.0001", distance between cutting tool and lower quill bearing must be held to a minimum. Here's how Fosdick minimizes this crucial distance.

The lower quill bearing is *permanently* located at the lowest possible position in the head, permits boring with spindle nose as close as 2½" to the bearing. Bearing does not ride up and down with quill and spindle as in conventional designs where balls are held in moving bushings.

The permanent location of quill bearings is made possible by unique Fosdick design—vertical ball races with preloaded precision balls circulating continuously. This design also permits spindle and quill to be shorter; thus stronger and more rigid. Both are perfect cylinders with no cuts on the outside.

Engineering advancements like this make the Fosmatic Jig Borer the most rigid and precise boring machine you can buy. Write today for the new catalog.

NEED JIG BORING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

New ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of Inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for catalog

SEE US AT BOOTH 1324 A.S.T.E. SHOW MARCH 19-23 INTERNATIONAL AMPHITHEATRE CHICAGO

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

Electrical Discharge Machining

saved $448 sinking this forging die using BRASS electrodes

Conventional Method

Mill Cavity (Man and Machine)	56 hours
Hand Finish (Experienced die sinker)	52 hours
TOTAL	108 hours

ELOX method

Forge Electrode (Man and machine)	2 hours
Set up and change electrodes (man and machine)	8 hours
Machine hours only (no operator required)	32 hours
Hand finish after E.D.M.	2 hours
TOTAL	44 hours

Saved: 64 hours at $7 per hour

additional EDM advantages in forge die machining:

- Dies are fully heat treated prior to machining thus eliminating possible distortion.
- Resizing forging dies after washout can be done within two hours.
- Inherent workhardening values are retained in the dies since no additional re-heat treating is necessary.
- Actual die life is increased.
- Many forge die alloys are self-polishing after EDM.

This machining application is one of many time and material saving jobs being turned out by the standard Elox M-500 Electronic Machine Tool. See EDM in operation at Elox Demonstration Centers.

*T.M. Reg.

elox

corporation of michigan

1833 Stevenson Hwy.
Royal Oak 3, Mich.

Elox Electron Drills for removing broken taps, drills, etc., from $495 to $3450.

DEMONSTRATION CENTERS

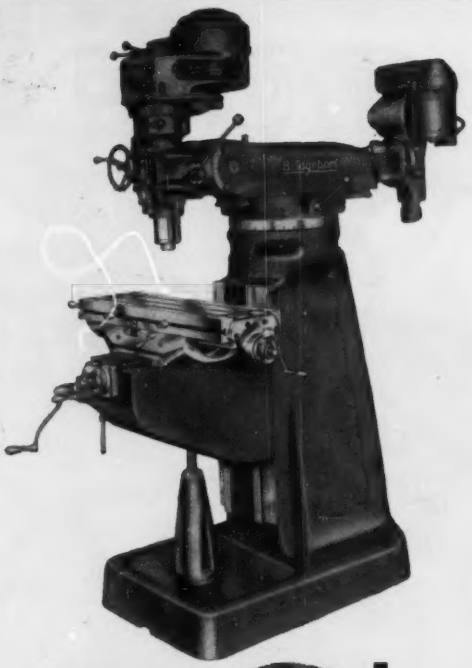
Plant—Royal Oak, Mich.
45 Broad Ave., Palisades Park, N.J.
1907 W. Monterey, Chicago, Ill.

The Basic Idea back of Bridgeport

TURRET MILLING MACHINES

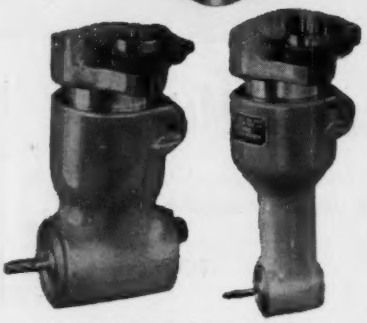
was conceived, created, developed and made universally practical by

BRIDGEPORT ENGINEERS



Universal acceptance of Bridgeport Millers has established beyond the shadow of a doubt that the basic principle in these machines is *RIGHT*. It also means that there was a definite need for a machine of this type to replace other machines which had outlived their usefulness. It means, too, that Bridgeport Turret Milling Machines can be installed in any shop for tool room or production line without radically upsetting procedures which have been in conventional use.

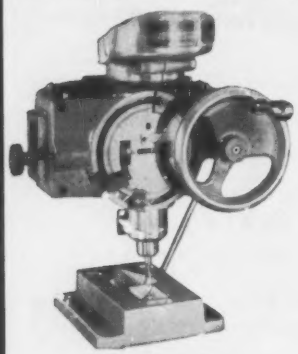
BRIDGEPORT MILLERS have met existing conditions universally. Careful planning in Bridgeport's own new shop has made it possible to offer *exclusive* advantages at a maintained reasonable price, a fact which indicates that their designers and manufacturers have made an outstanding contribution to modern metal working progress.



RIGHT ANGLE ATTACHMENTS

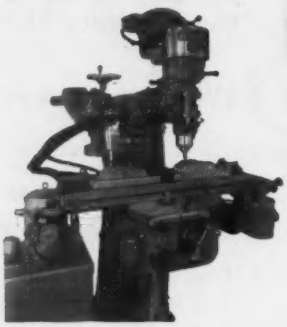
(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Above) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.



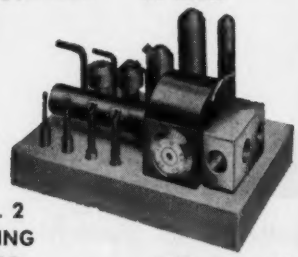
CHERRYING ATTACHMENT

Makes possible production of convex and concave shapes. Ideal for producing drop forge dies, molds, cavities.



TRUE TRACE COMBINATION

The Bridgeport True Trace Combination will give excellent performance and save endless hours when copying irregular dies and molds.



NO. 2 BORING HEAD

Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

Investigation of Bridgeport Milling Machines and their many attachments is always in order.

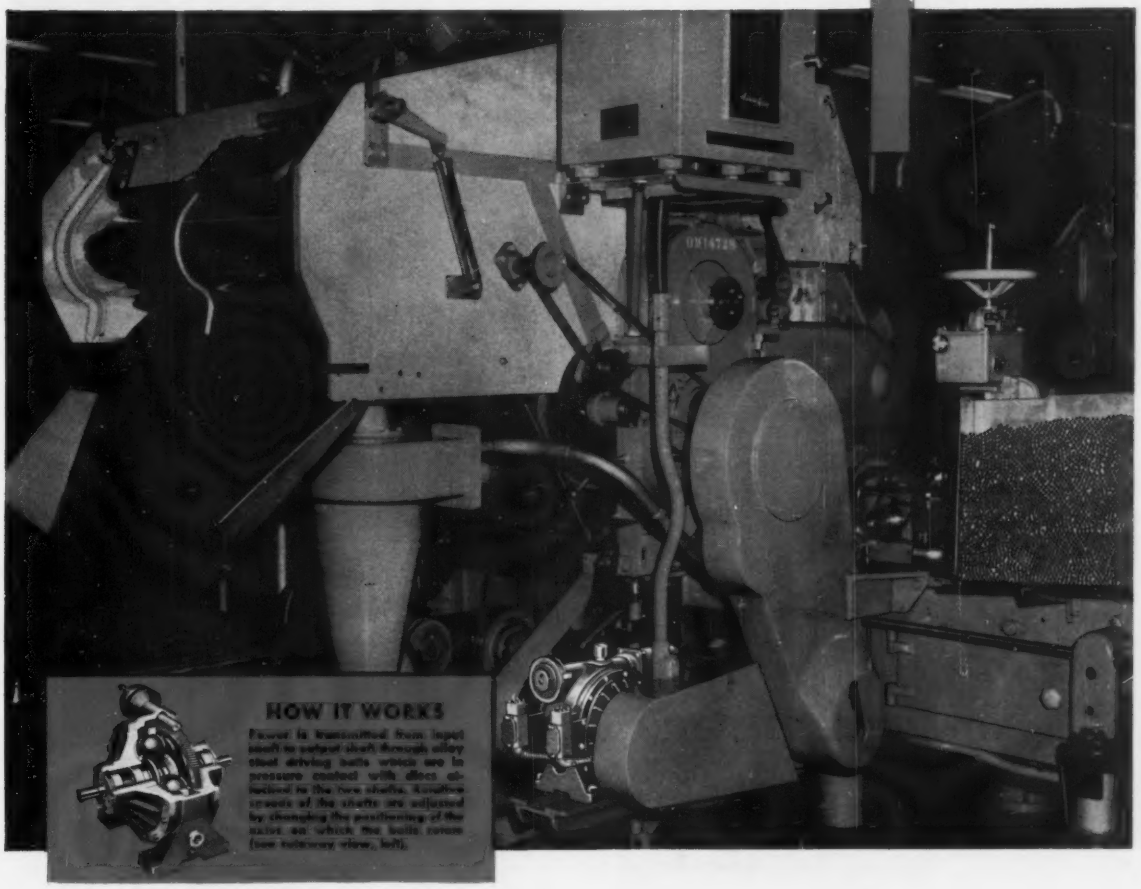
Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

AccuRay electronic brain gets muscle power from Cleveland Speed Variator

The electronic control mechanism of this cigarette machine, known as the AccuRay cigarette gage controller, built by Industrial Nucleonics Corp., Columbus, Ohio, employs Cleveland Speed Variator size 4K4, driven at 1200 rpm input.



NATIONALLY famous for checking and controlling the making of Chesterfield cigarettes, AccuRay depends on a Cleveland Speed Variator for the delicate job of adjusting the tobacco feed rate in response to impulses from the gaging mechanism.

Being infinitely variable, the Cleveland Speed Variator gives stepless speeds over a full 9:1 range—from ⅓ to 3 times input speed. Output speed on this application is adjusted automatically by a regulating motor mounted on the Variator—but could be regulated manually or by remote controls of other types.

Available in eighteen standard types and sizes, the Cleveland Speed Variator offers these major advantages: 1. An extremely compact unit with input and output shafts in line and rotating in the same direction; 2. Almost any input speed up to 1800 rpm can be used—either clockwise or counterclockwise rotation; 3. Rated for constant horsepower output over a 9:1 range, or for constant output torque with a 6:1 range; 4. Infinitely variable over the entire speed range; 5. Rapid response to speed change, precise adjustment, and accurate maintenance of speed settings; 6. Long life and minimum maintenance due to absence of belts or complicated linkages; 7. Ample bearing support for overhung pulleys on either input or output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3276 East 80th Street, Cleveland 4, Ohio

Sales Representatives in all major industrial markets • In Canada—Peacock Brothers Limited

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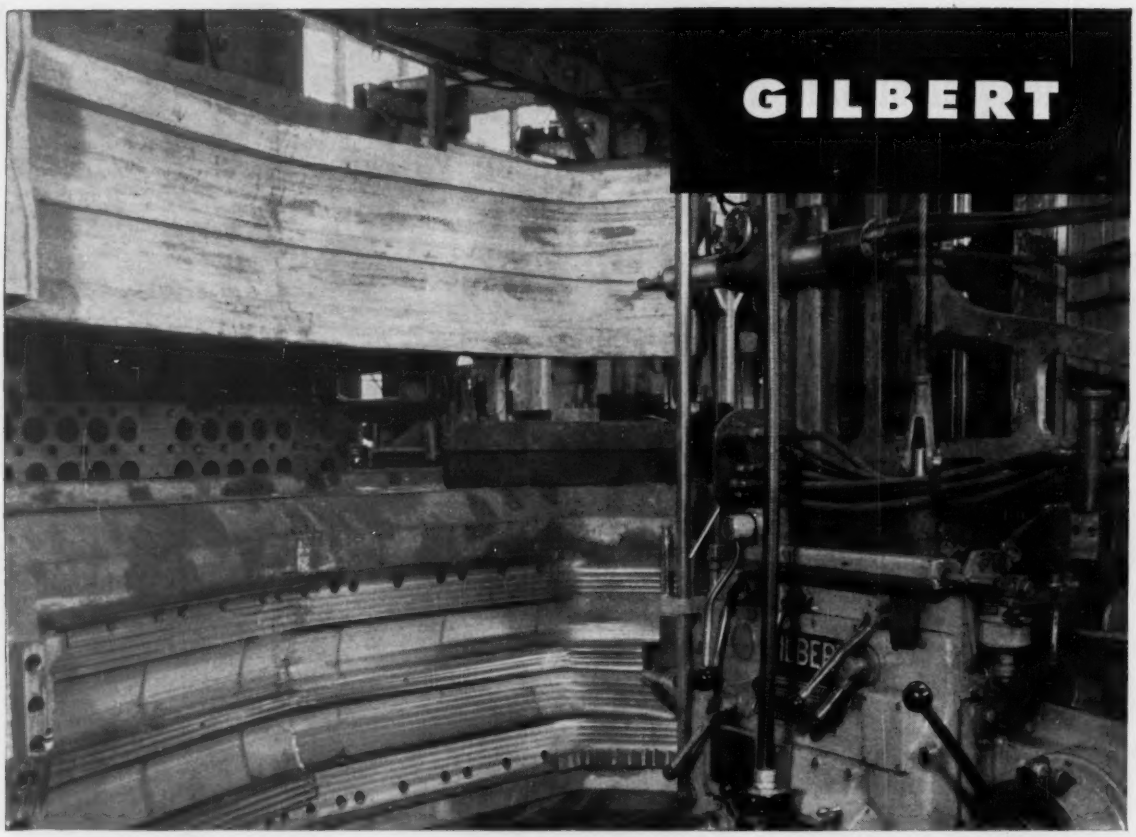
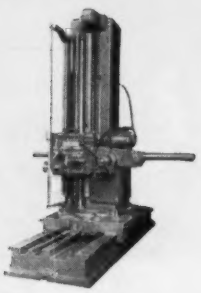


add reverse curves to your machining pitch



"The Gilbert revolving column boring mills, together with the very accurate Goodrich follower, make possible the machining of deep cavity, steep side dies complete in one position of the work piece.

"It is also possible to machine cupped ends or reverse curves without having to move the job."

These are the words of Mr. Ed Miller, President of the Lansing Tool & Die Company, Lansing, Mich. With his two Cincinnati Gilbert Floor Type boring mills, he has offered customers machining services which couldn't be done on any other horizontal mills. Other equipment capable of doing these jobs costs several times more than the Gilberts.

For profiling and duplicating, a Gilbert offers you quick profits on a low investment. Bulletin 954 contains full descriptions and specifications. Write for it today. *The Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.*

You can buy a new Gilbert floor type horizontal boring mill with 60" vertical and 72" horizontal travel on a 5-year payment plan for as little as $4040 down and $303.50 a month. This is 91c an hour on a two 8-hour-shift operation. Includes low 6% simple interest (3% add on).

those who buy Gilbert buy **GILBERT** *again*

flexible

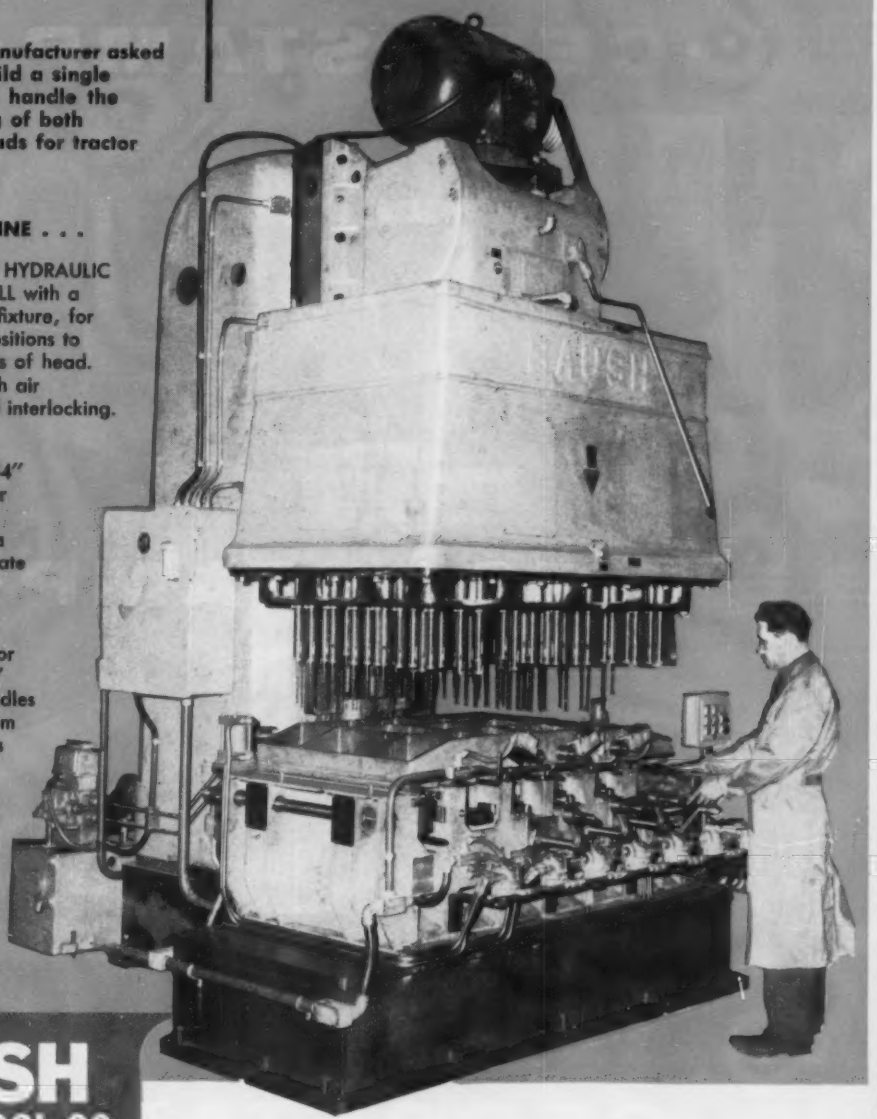
for drilling or reaming either 4 or 6 cylinder heads . . .

A leading tractor manufacturer asked us to design and build a single machine that would handle the drilling and reaming of both 4 and 6 cylinder heads for tractor engines.

HERE IS THE MACHINE . . .

BAUSH VERTICAL W-8 HYDRAULIC MULTIPLE SPINDLE DRILL with a 7-position tunnel-type fixture, for progressive working positions to drill and ream all sides of head. Fixture is equipped with air clamping and electrical interlocking.

Machine has a 28" x 54" rectangular fixed center head with a 2-speed geared yoke and has a master-bored cluster plate for 80 holes, furnished with 80 slip-sleeve adjustable joint driven spindles. By removing or inserting the ¼" to ⅝" tools in the proper spindles a quick changeover from 4 to 6 cylinder heads is made. Spindles are driven by a 30 H.P., 1800 RPM motor and hydraulic pump is driven by a 5 H.P., 1800 RPM motor.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Why not send us your machine tool problems — let's look over your prints — there is no obligation. Wire, phone or write us.

Four Cecostamps each working on a different piece. The one at the left is stamping cold rolled steel.

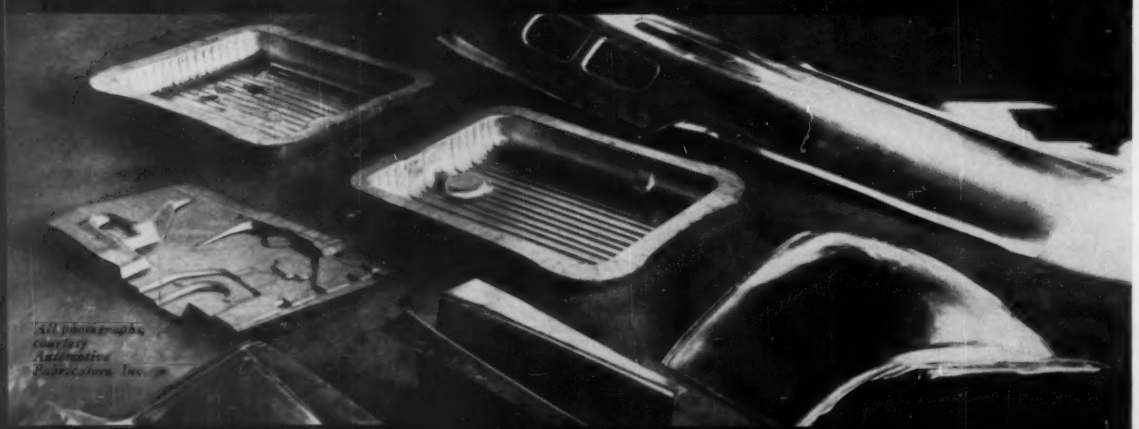
·CECOSTAMP·

The one left of center is stamping a wing skin of 24S.O. Aluminum. One in center is working on a firewall of 24S.O. Aluminum. One at extreme right is stamping tank parts.

Above is a close-up view of a Cecostamp producing a panel of cold rolled steel.

·CECOSTAMP·

This stamping is shown in the photograph below at the extreme left.



Stampings shown above are for aircraft and automotive use, made from a variety of metals and alloys.

·CECOSTAMP·

Top stamping is of 24S.O. Aluminum. Others are of Terne Plate, Cold Rolled Steel and 61S.O. Aluminum.

Have you the latest CECOSTAMP bulletin? Write CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa.

POPE PRECISION SPINDLES

Of Special Interest and Value To All TOOL ENGINEERS

See these Spindles at Federal Machinery Sales Co., Booth No. 392, ASTE Show

EXHIBIT A

POPE SUPER-PRECISION, HEAVY DUTY BORING SPINDLES for boring holes round within millionths of an inch. Available in both belt driven and motorized units to meet a wide range of speeds and horsepower. Send us your specifications for quotations.

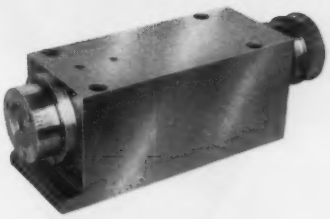
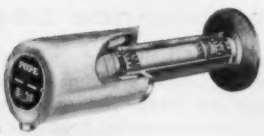
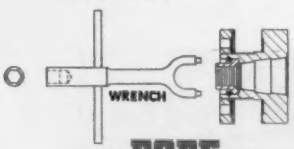


EXHIBIT B



POPE 1 HP, TOTALLY ENCLOSED 3600 RPM MOTORIZED, CARTRIDGE TYPE PRECISION SPINDLES with double row cylindrical roller bearings and separate thrust bearings for *no* endwise movement of the shaft

EXHIBIT C

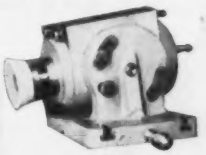


NEW **POPE** QUICK, SELF-REMOVING WHEEL HOLDER for surface grinders and tool and cutter grinders — eliminates the necessity of a wheel puller. Write for quotations.

EXHIBIT D

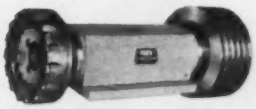
POPE HEAVY DUTY, ¾ TO 100 HP DIRECT MOTORIZED SPINDLES for Horizontal or Vertical Skin Milling, Grinding, Milling, Boring and Other Operations

EXHIBIT E



POPE SUPER-PRECISION MOTORIZED TOOL AND CUTTER GRINDER SPINDLES with clearance Angle Swiveling Heads for *Angular Adjustment In A Vertical Plane*

EXHIBIT F

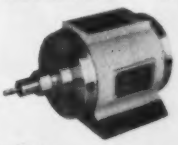


POPE HEAVY DUTY VEE-BELT DRIVEN, PRECISION MILLING SPINDLES, and Wheel Heads, ½ to 50 HP

EXHIBIT G

POPE INTERNAL GRINDING SPINDLES for Bryant, Excello, Heald and Landis Grinders.

EXHIBIT H



POPE SUPER-PRECISION HIGH FREQUENCY HEAVY DUTY GRINDING AND MILLING SPINDLES for speeds up to 100,000 RPM

WRITE FOR COMPLETE SPECIFICATIONS, PRICE AND DELIVERY

No. 108

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

FACTS

about

NEW DEPARTURE

BALL BEARINGS

Self-sealed bearings simplify design . . . cut maintenance costs

New Departure originated self-sealed ball bearings to eliminate the most common causes of bearing wear and failure—such as abrasive dirt and improper lubrication. Since then, more than 300,000,000 New Departure sealed bearings have been produced in various types to fit the specific requirements of industry. Seals are available to keep out foreign matter, ranging from dust and dirt to corrosive gases . . . to retain lubricants, varying from heavy grease to light oil . . . to provide the protection that assures longest life.

New Departure's latest advance, Sentri-Seal, embodies exclusive features which importantly improve both bearing performance and range of application. Because of its design, Sentri-Seal provides controlled, highly efficient sealing with low torque and is not materially influenced by axial movement due to bearing end play within prescribed tolerances.

Sealed ball bearings offer the electric motor and machine tool builder many advantages. They simplify design, make it possible to mount motors in any position, cut maintenance to a minimum, and eliminate the need for relubrication for long periods of operation.

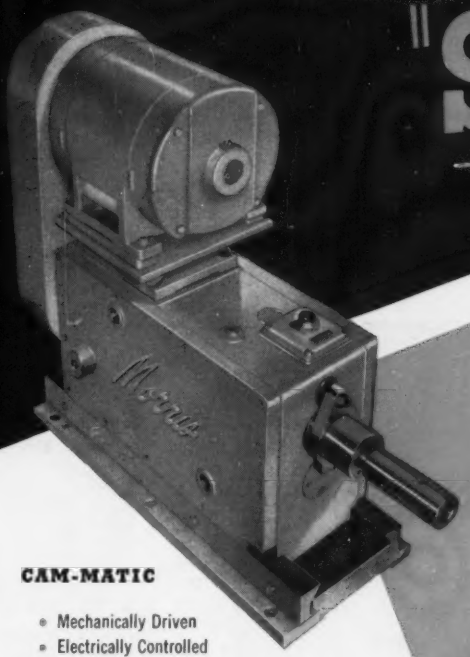
WRITE FOR COMPLETE INFORMATION ON NEW DEPARTURE SEALED BEARINGS!

NEW DEPARTURE • DIVISION OF GENERAL MOTORS CORPORATION • BRISTOL, CONN.

BUILD YOUR OWN "Specials"

with

Morris AUTOMATIC DRILL UNITS



CAM-MATIC

- Mechanically Driven
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- Exclusive Electric Clutch
- Adjustable Thrust Control
- Capacity to 1⅛", Stroke to 6"

AIR-OIL-MATIC

- Air or Oil Powered
- Oil Controlled
- Wide Range of Spindle Speeds
- Infinitely Variable Feed Stroke from 0" to 4½"
- 6" Maximum Stroke
- Convenient Feed and Stroke Adjustment

Whether you're building your own "special" production machine, organizing a completely automatic production line, or revamping drilling operations for more speed and higher efficiency . . . MORRIS Automatic Drill Units are flexible tools that assure improved drilling operation.

Choose from two basic types, in a variety of sizes and drives. Mount them in horizontal, vertical or angular positions . . . MORRIS Drill Units permit complete automatic control for precise drilling, reaming, tapping, spotfacing and allied operations.

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Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
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through cost savings . . . on
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Eliminate the necessity for outlining unusual shapes by drilling and chipping. Result? . . . greatly reduced tool costs.

The Oliver method utilizes power contour sawing, reducing filing to an absolute minimum. Table tilt also produces clearance for die work while filing. Files, saws, lapping sticks and hones can be used interchangeably.

Heavy-Duty Model illustrated. Four bench and pedestal type machines also supplied. Write for full details.

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Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

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American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

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Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
International Nickel Co., 67 Wall St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

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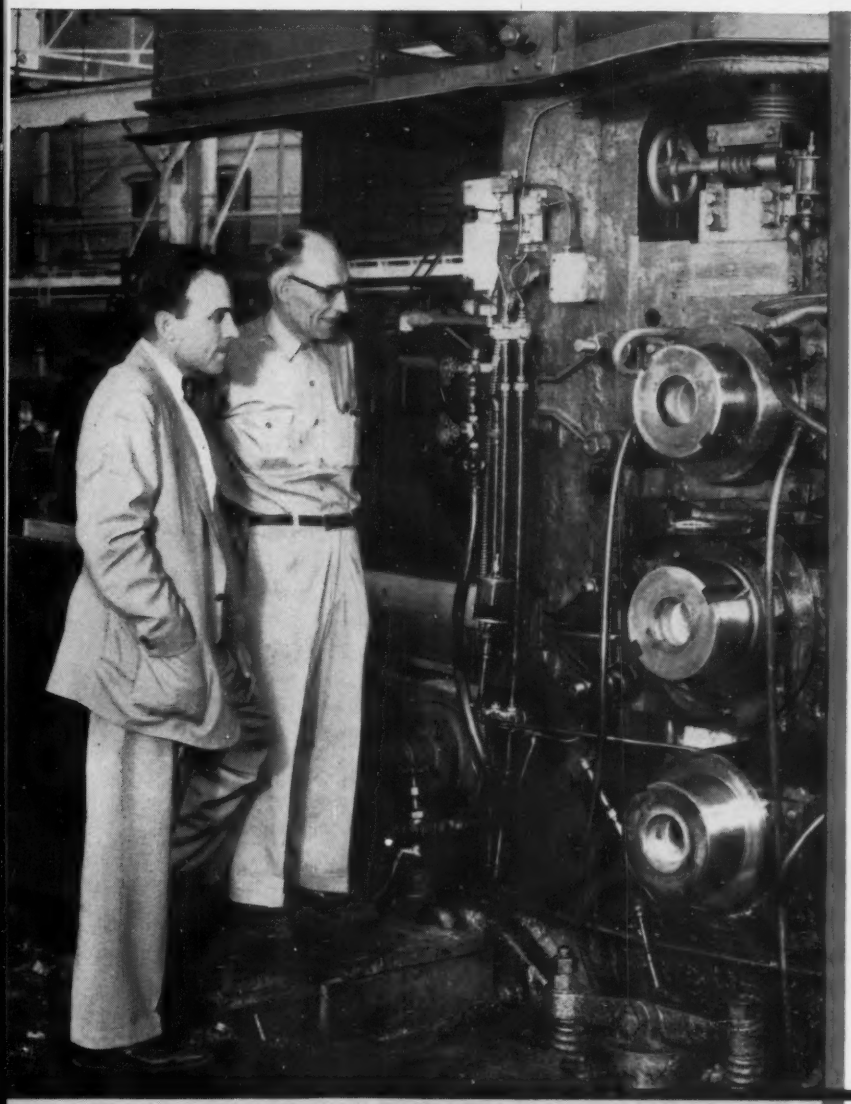
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
Le Count Tool Works, Inc., 390-L Capitol Ave., Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 300)

For more information fill in page number on Inquiry Card, on page 255

Sick slab roll recovers fast with application of STANOGEAR *Compound*



Eugene Ewald (right), Mill Foreman, and Marshall Fox, Standard Oil lubrication specialist, inspect slab roll. STANOGEAR Compound helped solve lubrication problem on roll neck bearings.

Marshall Fox who proposed switch to STANOGEAR with resultant improved operation, is experienced in providing such technical service. Marsh has a Mechanical Engineering degree from Purdue to qualify him for this work. In addition, he has completed Standard's course for sales engineers. This experience and training, customers find, pay off *for them.*

A slab roll at Matthiessen & Hegeler Zinc Company, La Salle, Illinois, was sick. It suffered from repeated roll neck bearing failures. Bearing temperatures couldn't be controlled. A consultant was summoned—Marshall J. Fox, Standard Oil lubrication specialist. His diagnosis and remedy: Install STANOGEAR Compound and equip the machine with a central pressure system for application. Recommendations were followed. Result: No bearing failures, due to faulty lubrication, since. Maintenance costs reduced. Time lost through breakdowns slashed.

This was a condition made to order for STANOGEAR to remedy. And Matthiessen & Hegeler knew there was a man at hand who could suggest what should be done. It's another demonstration of what this unbeatable combination can do when put to work:

1 **Standard Oil lubrication specialists capable of giving technical help.**

2 **Top quality products *that deliver results required.***

STANOGEAR Compounds contain special additives making them suitable for applications where heavy loads cause welding, seizure or scoring.

In the Midwest and Rocky Mountain states, a Standard Oil lubrication specialist in your nearby Standard Oil office will gladly give you more information about STANOGEAR. Call him. Or contact Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.

STANDARD

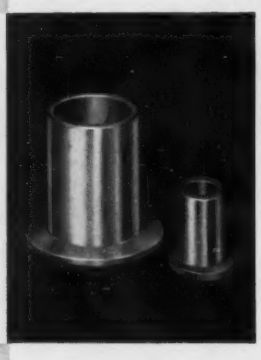
STANDARD OIL COMPANY

(Indiana)

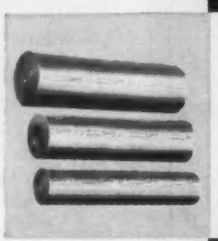
THIS *new*

BEARING SERVICE HELPS YOU IN MANY WAYS

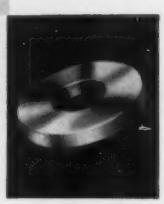
The development of a complete standardized line of stock Sintered Bronze Bearings and Bars by Bunting opens the door to many economies and advantages in production and maintenance of machinery and mechanical components.



Here is a far more complete range of standard sizes than has heretofore been available in this material. Bunting's powdered bronze stock line is the first to include all ASTM standard sizes to ASTM recommended dimensions and tolerances in both plain and flanged bearings and thrust bearings.



Together with the long established Bunting stock line of Cast Bronze Bearings and Bars, these new sintered bronze Bunting products bring to mechanical industry ready-to-use bearings that will squarely meet your blue print and cost requirements.



Both Bunting Cast Bronze and Bunting oil filled, self-lubricating sintered powdered Bronze Bearings and Bars are available to you through your nearest Bunting Distributor. He has in stock all sizes for your immediate needs. Ask him or write for complete lists and dimensional data on Bunting Cast Bronze and Bunting Sintered Bronze Bearings.

Bunting®

BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

The Bunting Brass and Bronze Company, Toledo 1, Ohio
Branches in Principal Cities • Distributors Everywhere

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Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

BALLS
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BARS, Phosphor Bronze
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Shenango-Penn Mold Co., Dover, Ohio

BARS, Steel
Allegheney Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded
Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio

BEARINGS, BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
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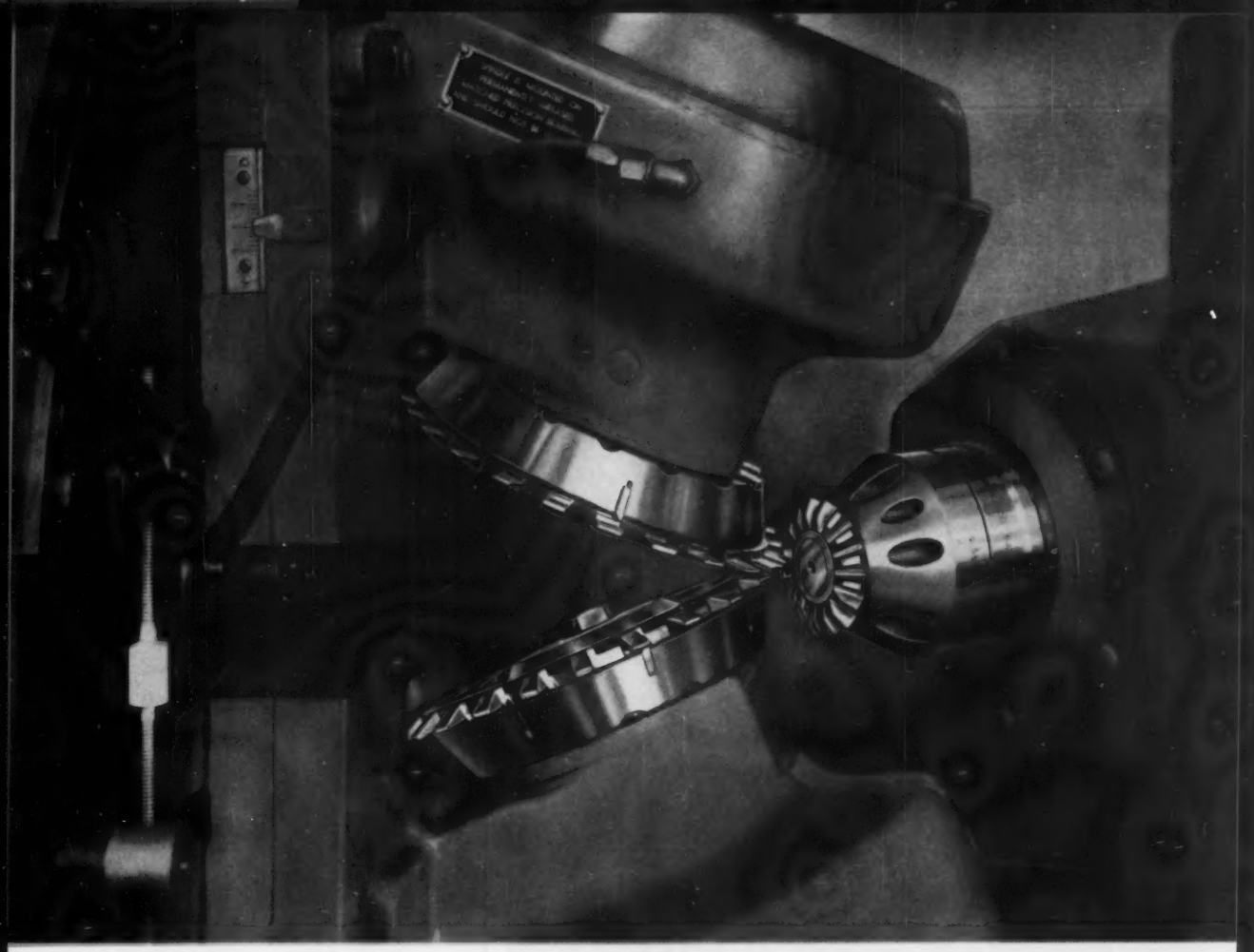
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

(*Continued on page* 302)

For more information fill in page number on Inquiry Card, on page 255



How to multiply production of straight bevel CONIFLEX® gears and pinions *by as much as 500%*

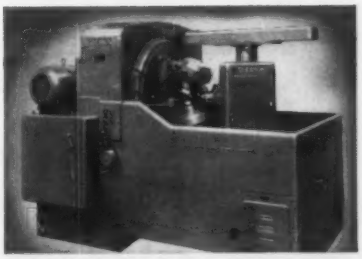
You can do it with the new No. 104 Straight Bevel CONIFLEX Generator.

The two interlocking disc-type cutters, with 24 blades each, *complete a gear in one rapid operation.*

This is the key to the remarkable performance of this new Gleason machine which achieves production rates up to 5 times as fast as any previous generator. In addition, a new generating method insures high efficiency, excellent finish, and maximum cutter life.

The range of capacity, and the ease of setup, make the No. 104 Straight Bevel CONIFLEX Generator ideal for jobbing.

Calculations have been reduced to a minimum and can be done long hand or with slide rule.



The No. 104 Straight Bevel CONIFLEX Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

We will be glad to send a bulletin giving further details on request.

® Straight bevel gears with localized tooth bearing.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

EXTRA SAFETY... AT NO EXTRA COST

with Williams patented *locking* adjustable

SAFETY FIRST — POSITIVE LOCK MAINTAINS SELECTED OPENING

SAFETY FIRST — NO ACCIDENTAL ROTATION OF ADJUSTING KNURL

SAFETY FIRST — POSITIVELY NO CHANGE IN ADJUSTMENT UNDER PRESSURE

● You can use a Williams Locking Adjustable with confidence. The sure-grip of its "locked-in" adjustment makes it safer to use.

Why accept less when you can get the best . . . at no extra cost. Made in 6, 8, 10 and 12 inch sizes. You'll get prompt service at lowest cost by ordering through your local distributor.

J. H. WILLIAMS & CO. 408 VULCAN STREET BUFFALO 7, N. Y.

WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilness)
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

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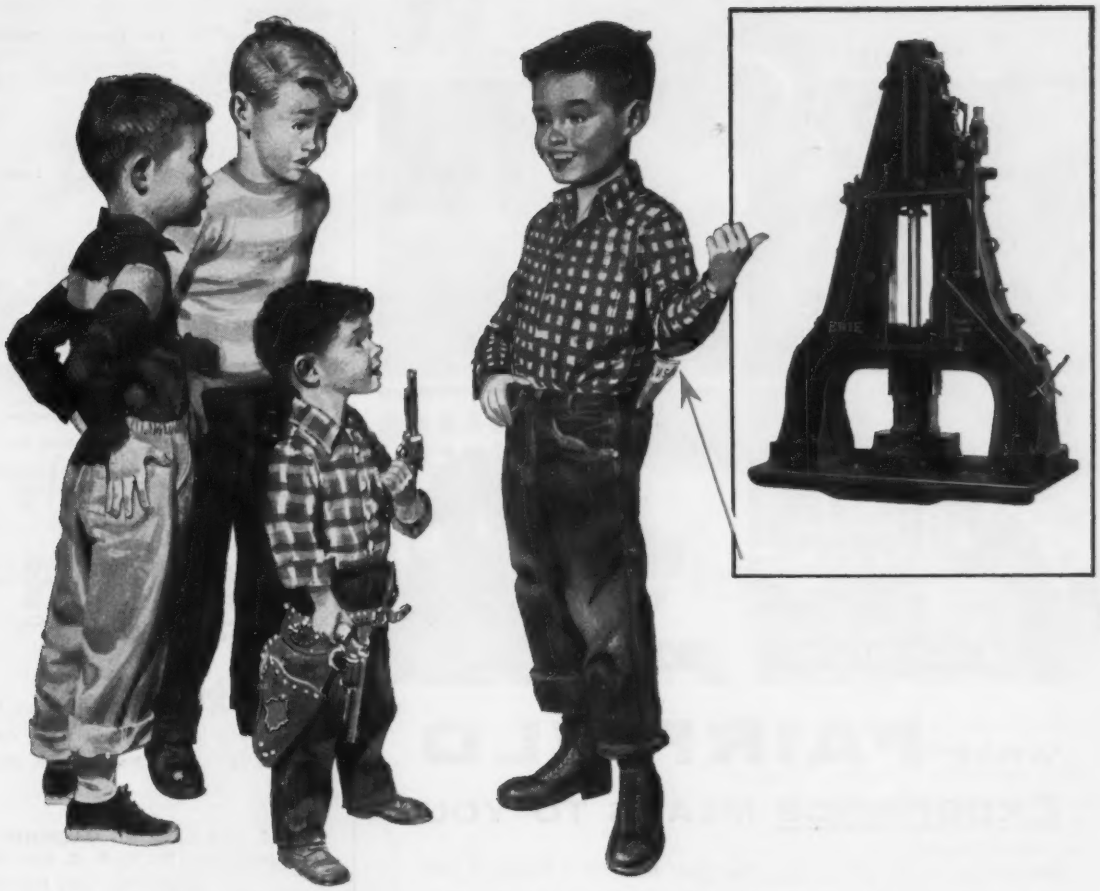
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy, Chicago, Ill.

BLAST CLEANING EQUIPMENT
Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.,
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page* 304)



and this, Rangers is my dad's brand new 10,000-lb. double frame hammer complete with redesigned valves, larger port openings through valves, and streamlined steam passages!

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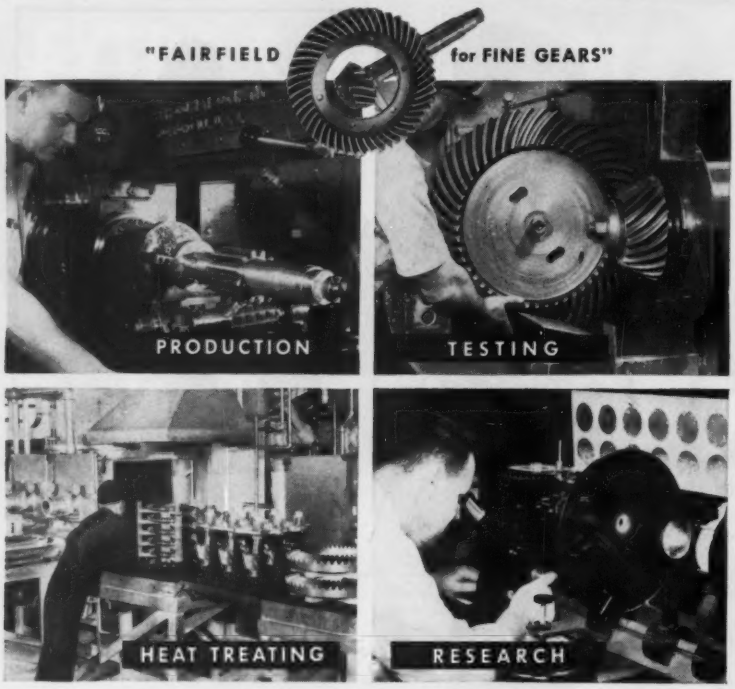

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BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2 Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLT AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
University of Oklahoma Press, Norman, Oklahoma

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page* 306)

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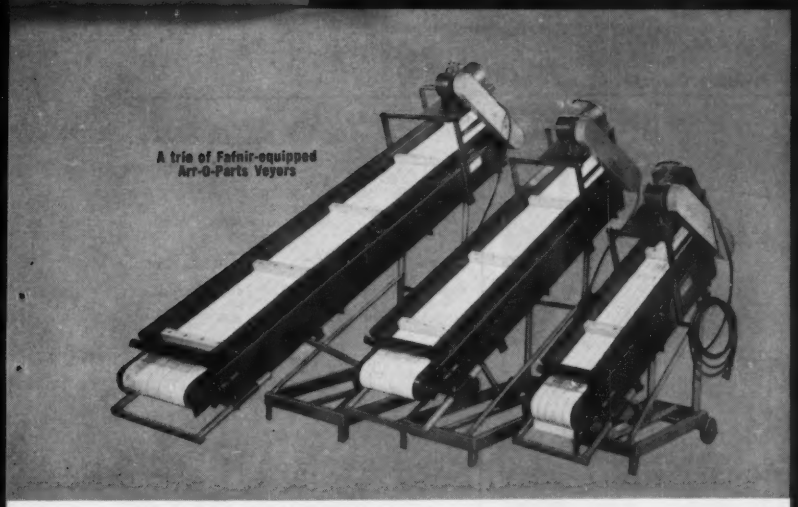

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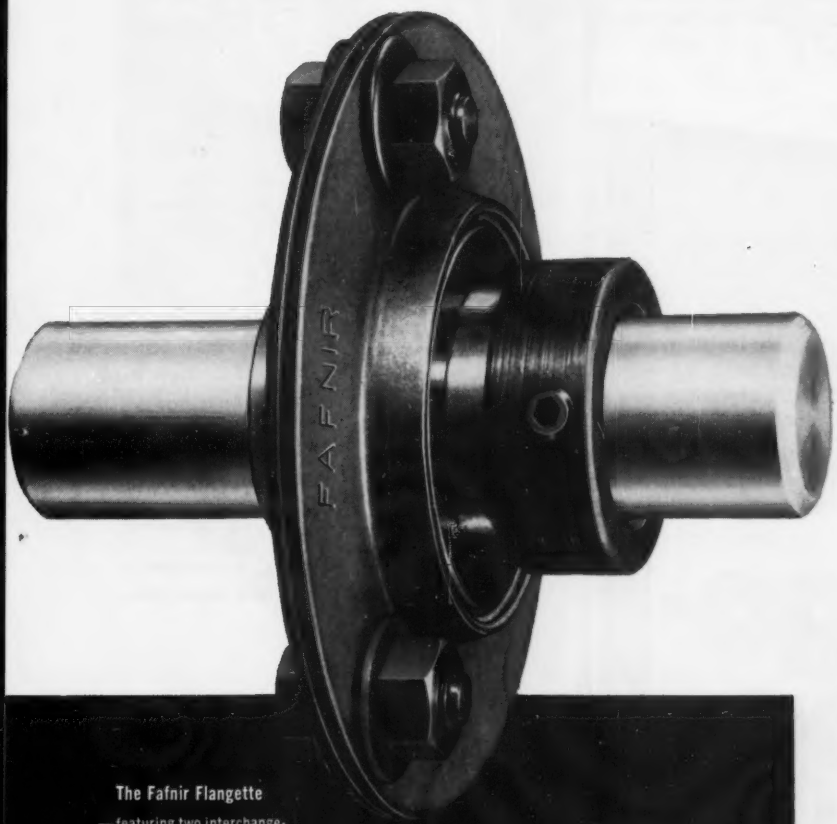

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—featuring two interchangeable pressed steel flanges, a precision ball bearing and a choice of two types of seals, Mechani-Seals or Piva-Seals. The bearing has the famous Fafnir eccentric cam-type collar, making it the easiest of all to install.

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Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bon St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(*Continued on page* 308)

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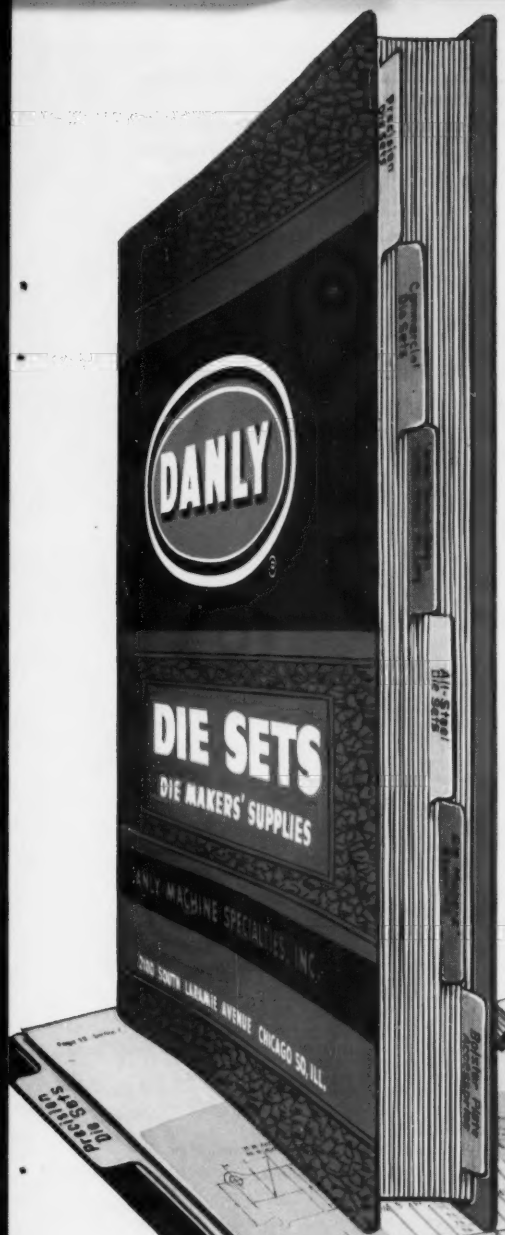

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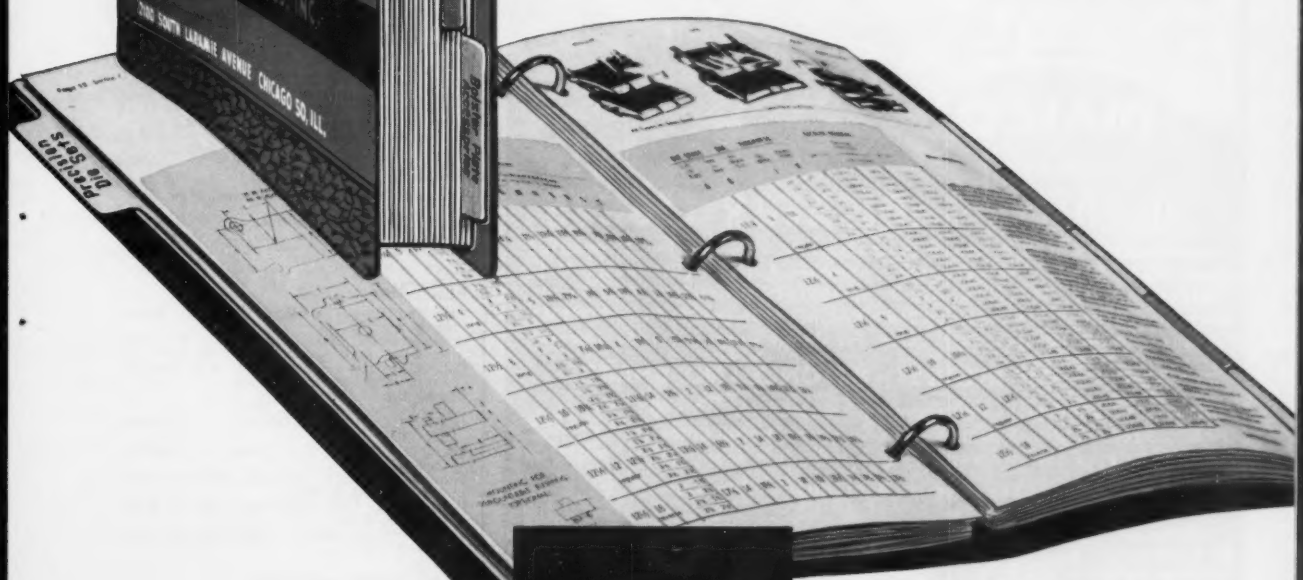

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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
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Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr. George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown Ohio.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
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Ferracute Machine Co., Bridgeton, N. J.
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Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

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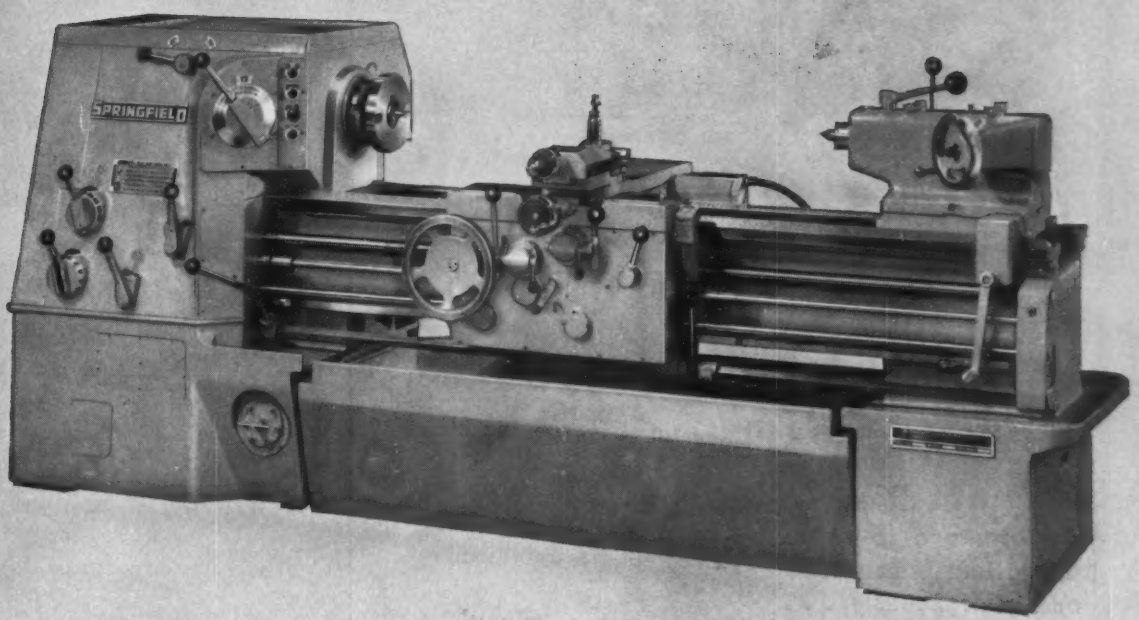

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Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
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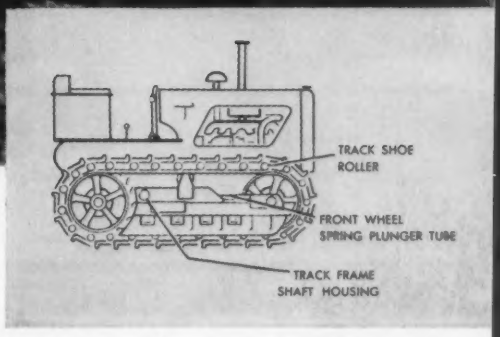
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

(*Continued on page* 312)



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USS **SHELBY SEAMLESS MECHANICAL TUBING**

UNITED STATES STEEL

SHIMS

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THE LAMISOL® SHIM

FOR QUICK, ASSEMBLY LINE USE

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COMPANY_____

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CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Aves., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Shenango-Penn Mold Co., Dover, Ohio

CASTINGS, DIE

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Shenango-Penn Mold Co., Dover, Ohio

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page* 314)

For more information fill in page number on Inquiry Card, on page 255

NEW!

Revolutionary AIRengineering Development by Ingersoll-Rand . .

TORSION BAR

Torque control

IMPACTOOLS

MULTIPLE TORQUE SETTINGS
2 TORSION BARS AVAILABLE:

- **No. L735. Max. torque 60 ft. lbs.**
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Size 5040T*

***For torques up to 550 ft. lbs., a Size 5340T *Torque Control* Impactool is available**

. . . how can YOU use these ADVANTAGES ON NUT RUNNING JOBS *where prescribed torques must be met?*

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
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CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
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Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 316)

Why Grind or Finish-Bore?
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★ MORE ACCURATELY
with a FULMER HONING MACHINE!
Switch from grinding or finish boring to Fulmer Honing! There's a double saving: you cut costs and release boring or grinding machinery for other uses.
Fulmer Honing Machines speed production and lower costs. Ruggedly constructed and engineered to handle greater loads than normal. They assure low upkeep under the most severe operating conditions and provide ample cutting power to the stones.
FULMER machines are designed with a minimum number of parts for minimum maintenance. Five basic sizes provide a machine fitted to any needs. Fulmer precision honing
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FULMER honing equipment

For more information fill in page number on Inquiry Card, on page 255

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give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

see these new chucks at . . .

BOOTH 579 ASTE SHOW

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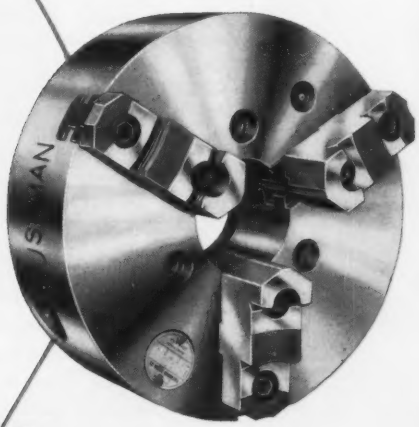
- Simple, quick adjustment . . . repeats to .0005" T.I.R.
- Ideal for precision bar work.
- Rigid body with positive locking eliminates rotational slippage.
- Available with 3 or 6 jaws.



manually operated compensating chucks

- Maximum compensation with precision performance.
- Permits holding irregularly shaped workpieces.
- Available for medium or heavy duty work.

air operated compensating chucks

- Greater compensating action than ever before possible.
- The advantage of two chucks in one body . . . compensating action or regular self-centering operation.

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a world standard for precision

CUSHMAN the CHUCKMAN CHUCKS AND ACCESSORIES 1862

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Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

* Patent applied for.

2CS56A

CHUCKS, Magnetic
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

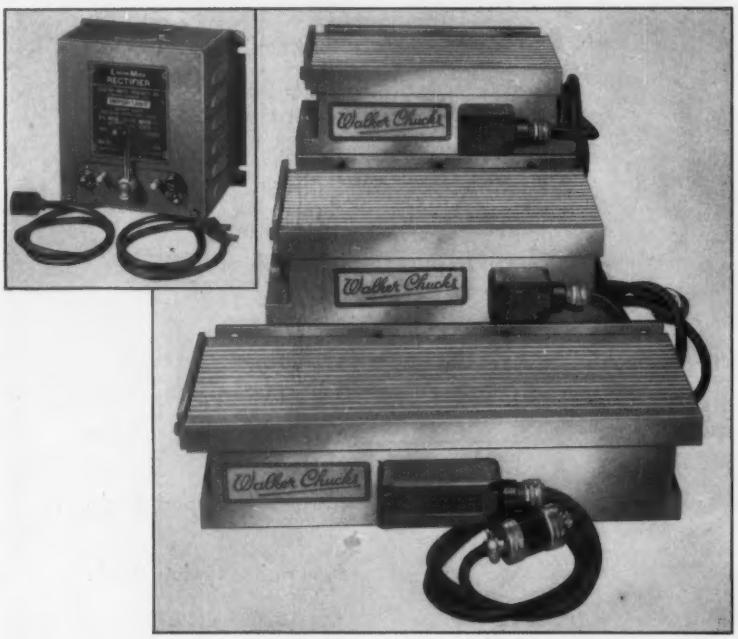
CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

Walker Chucks
You May As Well Have the Best



Walker Longitudinal Bar Pole Chucks . . . three popular sizes . . . low wattage, low price, maximum holding.

5" x 10"	$ 78.00
6" x 12"	$110.00
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KD Rectifier with built-in switch to operate from any AC line $43.00

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WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

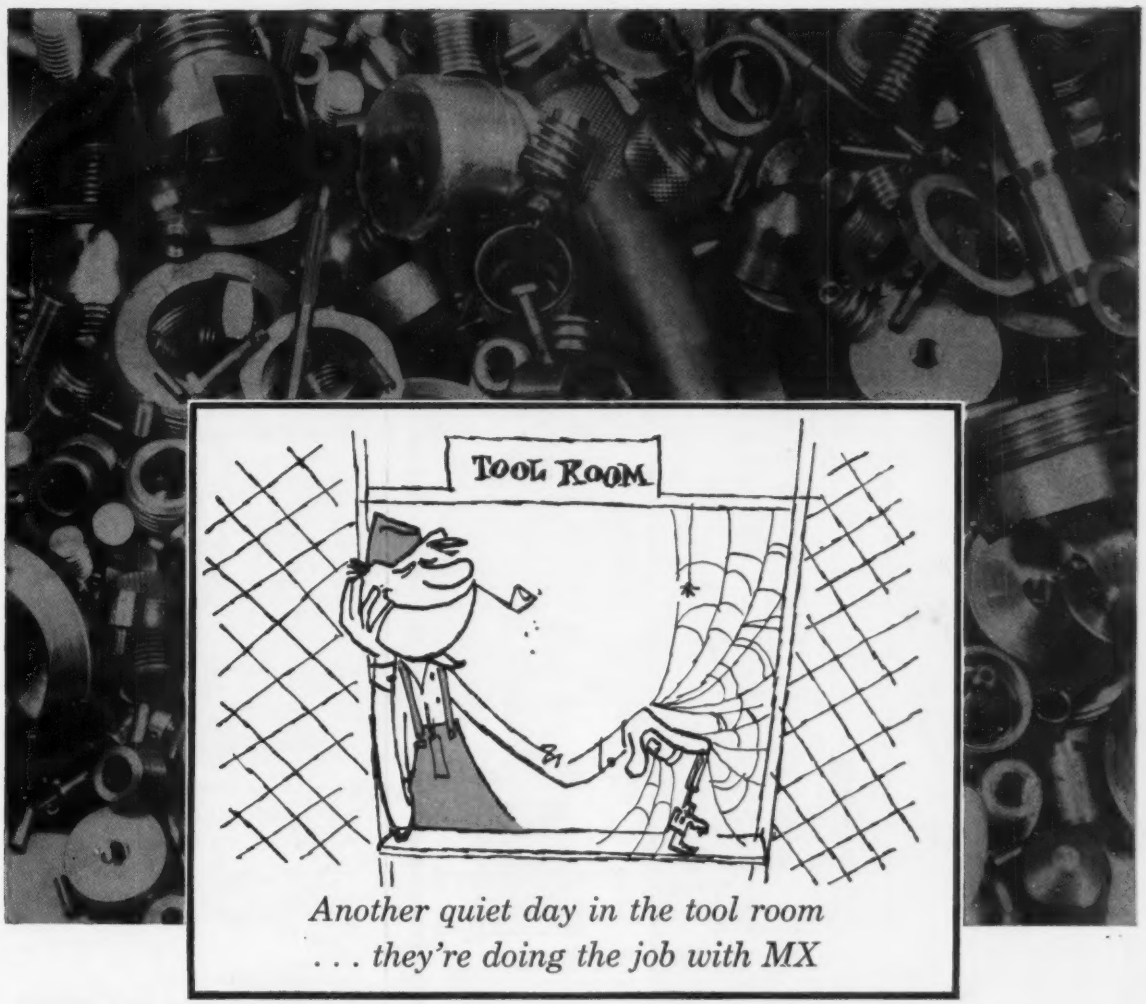
COMPARATORS
See Gages, Comparator.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(*Continued on page* 318)



Another quiet day in the tool room
. . . they're doing the job with MX

USS FREE-MACHINING MX STEEL works *with* your tools, not against them. That's because USS MX has been specifically designed to ensure maximum cutting speeds compatible with economical tool life — and it does exactly that.

As a result, in the hundreds of shops that have put MX to work, tools have lasted up to 200% longer. Cutting speeds have increased as much as 50%. Output has been boosted an average of 40%.

USS MX has so consistently outperformed ordinary screw stock that we can tell you with complete confidence that *MX will cut the cost of any part* you now machine from regular Bessemer grades. What's more, the parts you make will be *better* parts—more accurate, of better finish. Rejects will be fewer.

And here's another reason why MX is your best buy today. Despite the fact that it *costs no more than ordinary screw stock*, USS MX has been successfully machined at speeds approaching 350 SFM — speeds far higher than the average (under 250 SFM) used in most shops today.

Available in both Bessemer and Open Hearth grades, USS Free-Machining MX Steel is produced in all the popular screw stock sizes. It is sold in cold finished form by your regular supplier, either as "MX" or under his identifying trade name. In hot-rolled form, MX is available through our nearest sales office.

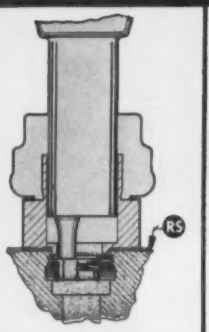
UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs
—when you do the job with free-machining MX

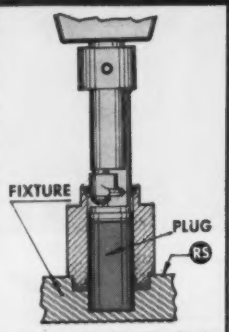
USS

UNITED STATES STEEL

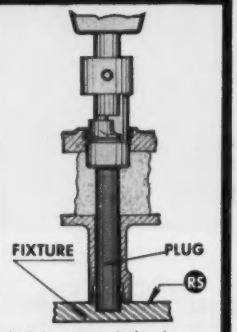
Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



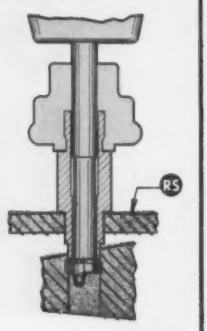
A) Cuts two grooves of different depths and widths in one single operation from same reference surface.



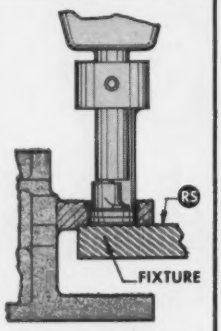
B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.



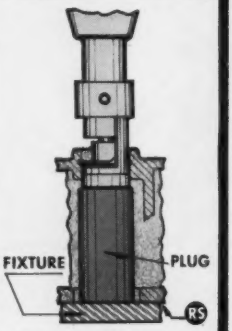
C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.



D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.



E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.



F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

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Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

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Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Molding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant

COOLANT SYSTEMS

Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.

COPPER

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(*Continued on page 320*)

For more information fill in page number on Inquiry Card, on page 255

Saves Time... Cuts Costs

Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

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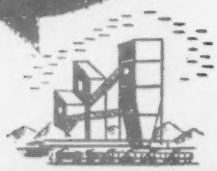
Efficient

LOW COST PIERCING of COMPONENT PARTS *for*

TRUCKS



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FARM EQUIPMENT
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Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible

Boston Gear Works 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Standard Pressed Steel Co., Jenkintown, Pa.

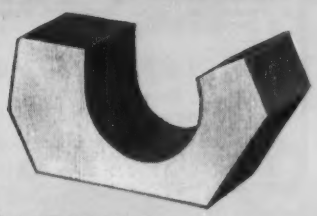
CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS

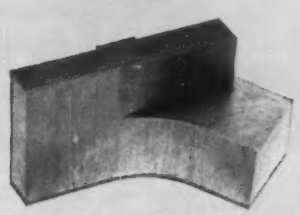
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(*Continued on page* 322)

PARTS SHAPED FASTER WITH
Demon
HIGH-SPEED STEEL SAW BANDS



NOW 60 min. with Demon Saw.
Was 100 min. with carbon steel saw.
Was 15 hours on shaper.

Product:
Double Knee Turner
1045 Steel



NOW 28 min. with Demon Saw.
Was 60 min. with carbon steel saw.
Was 8 hours on shaper.

Product:
Knee Turner
Steel

NOW 15 min. with Demon Saw.
Was 40 min. with carbon steel saw.
Was 9½ hours on shaper.

Product:
Shaving Tool Holder Slide
SAE1045

New DoALL Saw Band Shapes Solid Steel Faster Than Any Other Tool

The revolutionary Demon High-Speed Steel Saw Band and its companion, the versatile Contour-matic Band Machine, make it possible to cut critical parts from solid steel or steel forgings faster than has ever been possible before!

DoALL Demon High-Speed Steel Saw Bands slice through the toughest steels up to 10 times faster and with up to 30 times longer life than carbon steel saw bands. This makes the proven world's fastest machining method even faster.

Since the contour sawing method wastes no time making chips out of valuable metal but cuts right to the layout line, removing unwanted metal in chunks, it is possible to maintain high standards of strength and quality in critical machine parts with a decrease in machining cost.

Ask for a demonstration. See Contour Sawing at its best — the DoALL Contour-matic with Demon High-Speed Steel Saw Bands. It's terrific, absolutely amazing and a definite means of making your machining operations more profitable.

Demon and Contour-matic are registered trade marks of The DoALL Company.

See DoALL at the ASTE Show Booth 1520 March 19-23 International Amphitheater Chicago, Ill.

THE DoALL COMPANY
Des Plaines, Illinois

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REED RID CO.

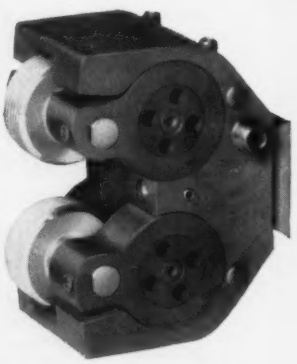
NEW SERIES B

Thread Rolling Attachments

for Automatic Screw Machines

Produce Uniformly Accurate Smooth and Stronger Threads

Assure Low Tool Cost, Continuous Production with Less Down Time



- **4 Standard Sizes**
- For over 100 different single and multiple screw machines
- Adapters for more than 300 cross-slide applications
- Easy to set up and operate
- Simple precision matching with prematched rolls
- Complete instruction book with each attachment

SELF-COMPENSATING ROLL ACTION simplifies setup, provides longer roll life and reduces down time to a minimum. The ***side and alignment compensators*** ease undesirable side pressures on the rolls and assure smooth contact and withdrawal of the rolls from the work. The ***advance compensator*** allows rolls of the same diameter to be used and permits either roll to contact the work blank first.

FULL DIAMETER RANGE TO MAXIMUM CAPACITY

Model No.	Thread Diameter Range	Approximate Number of Common Thread Sizes That May Be Rolled
B10	0—5/8"	80
B13	1/8"—13/16"	90
B18	1/4"—1 1/8"	105
B36	3/8"—2 1/4"	170

Write for Attachment Bulletin B-1

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CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl Co., Rochester, Mich.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co. 1220 Woodward Heights Blvd,, Ferndale, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

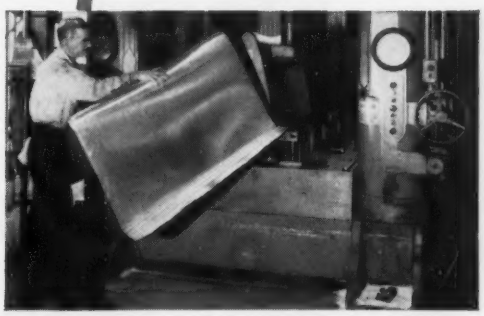
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.

(*Continued on page 324*)

Ingenious Tooling– versatile H-P-M



Convair Adapts Standard H-P-M 1000 Ton For Stretch Forming

Here's proof of the unlimited versatility of H-P-M hydraulics. In this unusual application, Convair Division of General Dynamics Corp. of San Diego, use an H-P-M all-hydraulic 1000 ton double action press for stretch forming aluminum Convair-Liner dorsal fins. The accurately controlled hydraulic pressure of the H-P-M press throughout drawing and clamping action assures proper metal forming over a plastic die. Equipped with the time-proved H-P-M FAST-RAVERSE Closed Circuit hydraulic system, dependable H-P-Ms offer the solution for most tough metalworking problems. Nearly 80 years of experience stand behind thousands of these H-P-M presses now in production all over the world. Call in a nearby H-P-M engineer at the planning stage. He may be able to save you real money.

H-P-M all-hydraulic 1000-ton FASTRAVERSE sheet metal drawing press equipped with a 400-ton blank-holder and 250-ton die cushion.

METAL WORKING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

For more information fill in page number on Inquiry Card, on page 235

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Ames instruments have been making industrial measurement history for more than half a century. Extremely adaptable, they have solved hundreds of tough measuring jobs while providing unquestioned accuracy through many millions of cycles. Ames indicators and gauges enjoy a reputation as the finest you can buy . . . simply because we have *always* employed expert craftsmen and the highest quality materials.

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March 19-23

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Lewis Machine Co., 3441 E. 76th St., Cleveland 27, Ohio
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel
Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.

CUTTING-OFF MACHINES, Cold Saw
See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.

CUTTING-OFF TOOLS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

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Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Shenango-Penn Mold Co., Dover, Ohio
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

CYLINDERS, Pneumatic
Shenango-Penn Mold Co., Dover, Ohio

DEALERS, Machinery
Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

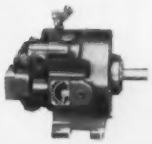
(*Continued on page* 326)

What's New in VICKERS HYDRAULICS

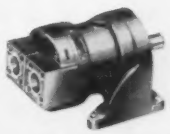
Illustrated here are new and recently improved units added to Vickers most complete line of oil hydraulic equipment. Look to Vickers as a single responsible source for integrated hydraulic systems. For characteristics of any of these components, please write for Installation Drawings by number.

SERIES T8 PIPELESS POWER PACKAGE consists basically of electric motor, hydraulic pump, control circuit and reservoir. Available in 3 circuits, 3 pump sizes and 3 electric motor sizes. Inst. Dwgs. 178706, 7 & 8.

V-LINE PISTON PUMPS AND MOTORS for 5000 psi. Unique design minimizes relative movement between rotating parts, provides increased bearing surfaces and reduces complexity of parts. Result is improved efficiency, longer life, and reduced maintenance. Supplied with straight thread connections. Bulletin 55-72.

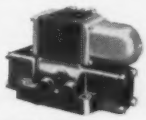


Variable Displacement Pump With Servo Control. Inst. Dwg. 179061. Also available with pressure compensator control. Inst. Dwg. 179060.



Constant Displacement Fluid Motor. Inst. Dwg. 179059. Available also is a Constant Displacement Piston Pump. Inst. Dwg. 179058.

DG4S4 ⅜" solenoid operated. Inst. Dwg. 182412. ¼" available later.

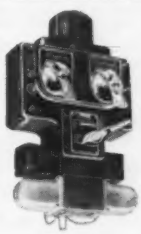


DG5S4 ¾" solenoid controlled pilot operated. Inst. Dwg. 182413. 1¼", 2", 3" available later.

SOLENOID OPERATED 2- AND 4-WAY VALVES with many improved features. (1) Integral junction box (2) covers that retain the solenoids and (3) manual operation for testing. Compact and versatile. Gasket mounting simplifies installation and overhaul . . . also minimizes piping.

SEE VICKERS EXHIBIT at the TOOL SHOW BOOTH 1411

TRAVERSE AND FEED CYCLE CONTROL PANEL Improved design. Provides any cycle sequence of rapid advance, adjustable feed, dwell and rapid return motions. Maintains smooth and constant preset feed rate (either one or two) regardless of fluctuations in cutting tool resistance or hydraulic pressure.



CPP-2242 Solenoid Controlled. Pilot Operated (gasket mounted) provides smooth, low current operation. Inst. Dwg. 182414.

CG-03 Relief Valve (gasket mounted). Subplates available with pipe or straight thread connections. Inst. Dwg. 175630. CS-03 available with straight thread connections. Inst. Dwg. 175629.

CO2 Reciprocating Cycle Control Panel For Gasket Mounting. Inst. Dwg. 177083.

4CG-03 Pilot Operated Check Valve, gasket mounted. Inst. Dwg. 135468.

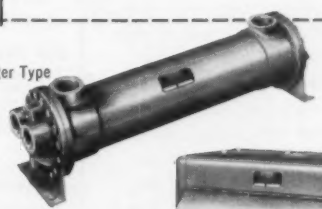
CG-714 Deceleration Valve, gasket mounted. Inst. Dwg. 172902.

CGV-06 5000 psi Relief Valve gasket mounted with straight thread connections. Inst. Dwg. 177609.

URG1 Unloading Relief Valve, gasket mounted. Inst. Dwg. 178974.

SG1 Pressure Switch, gasket mounted. Inst. Dwg. 172538.

Water Type



OIL COOLERS Vickers Oil Coolers are characterized by their very high rate of heat transfer per unit of space occupied. Bulletin 55-69.

Air Type

For further information on any unit shown, ask for Installation Drawing by number indicated. 7435

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information fill in page number on Inquiry Card, on page 253

SKINNER

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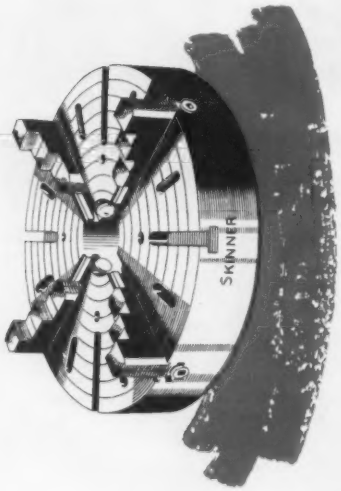
CHUCKS



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Skinner Independent Chucks are available in various models for medium and heavy duty tool room and general machine shop work. Sizes range from 4½" to 36", with semi-steel or steel bodies. All other parts are heat-treated alloy steel. Jaws are solid reversible or two-piece with reversible tops for either internal or external gripping. Soft blank top jaws available. The body surrounds more than 60% of each operating screw for the full length of the screw, to assure proper alignment and long life.

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ASTE BOOTH 263

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Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

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Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

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DIE-CASTING MACHINES
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

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Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
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Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

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Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
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Cincinnati Milling Mch. Co., Cincinnati, Ohio.
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DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

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Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.

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Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
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(*Continued on page* 328)

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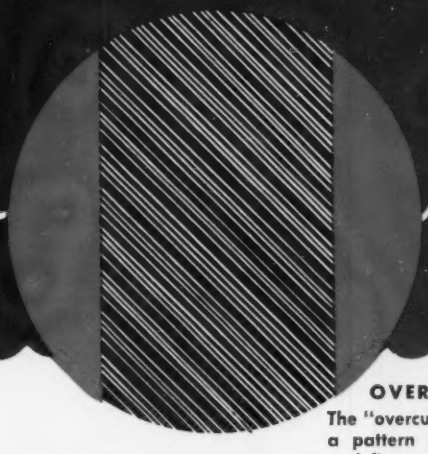
HELLER NUCUT® Wavy-Teeth® FILES



OVERCUT
The "overcut" creates a pattern of coarse and fine teeth.

HELLER Nucut Wavy-Teeth design combines both coarse and fine teeth in the same file to give fast stock removal and leave a smooth finish.

The coarse teeth cut fast, take a good bite, while the fine teeth break up the chips and permit quick clearing from the file.

This DOUBLE ACTION makes it possible to file with less effort and remove more metal with fewer strokes. Loading is minimized, chatter reduced and a smoother finish produced.

This is why HELLER Wavy-Teeth files are easier to use, last longer, cut filing costs. It will pay you to ask for HELLER NUCUT WAVY-TEETH next time you order files!

UPCUT and OVERCUT FINISHED FILE
When the "upcut" is added the "Wavy-Teeth" design is created with larger cutting teeth and smaller clearing teeth.

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Subsidiary of Simonds Saw and Steel Co.

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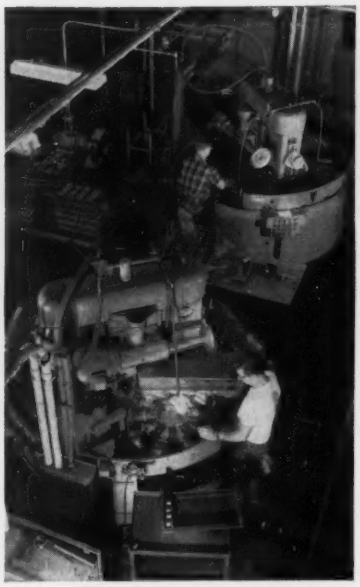

These Besly-Bowen 711 Radial Head Grinders, equipped with 18" abrasive wheels, finish grind steel compressor cylinder brackets. Picture shows how grinding takes place at one table while the other table is unloaded (grinder at right).

At General Electric's amazing Appliance Park — where all major household appliance manufacturing is centralized—Besly-Bowen Grinders are doing a remarkable job.

The machines pictured at the right — Besly-Bowen 707's and 711's — turn out a variety of parts, including refrigerator compressor pistons and steel compressor cylinder brackets also used in refrigerators. Simple enough to do, with the right equipment, and Besly grinders have come up with the answers. Result: tolerances held to microscopic dimensions, virtually automatic continuous operation with loading and unloading at one station while grinding takes place at the other. All of this adds up to precision parts, ground at high speed and low cost.

Positioning compressor pistons for finish grinding in a Besly-Bowen 707 Grinder, while grinding takes place at the machine's second table. 400 pieces per hour are ground to .001" for size and .0005" for flatness.

On another Besly Double Horizontal Spindle Disc Grinder valve discs used in refrigerators are ground 950 pieces per hour with tolerances held to plus .00015" and *minus zero* — all in a single pass that takes less than 4 seconds!

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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Metal Carbides Corp., Youngstown, Ohio.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Buffalo Forge Co., Broadway, Buffalo, N. Y.
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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakewood Blvd., Cleveland 23, Ohio.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
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(*Continued on page* 330)

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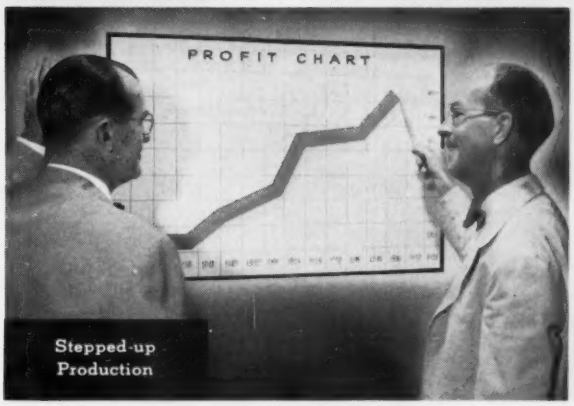

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
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Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
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Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
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Wales-Strippet Corp., North Tanawanda, N. Y.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
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Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
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Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
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(*Continued on page* 332)

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BRAND
BALL BEARING CHUCKS

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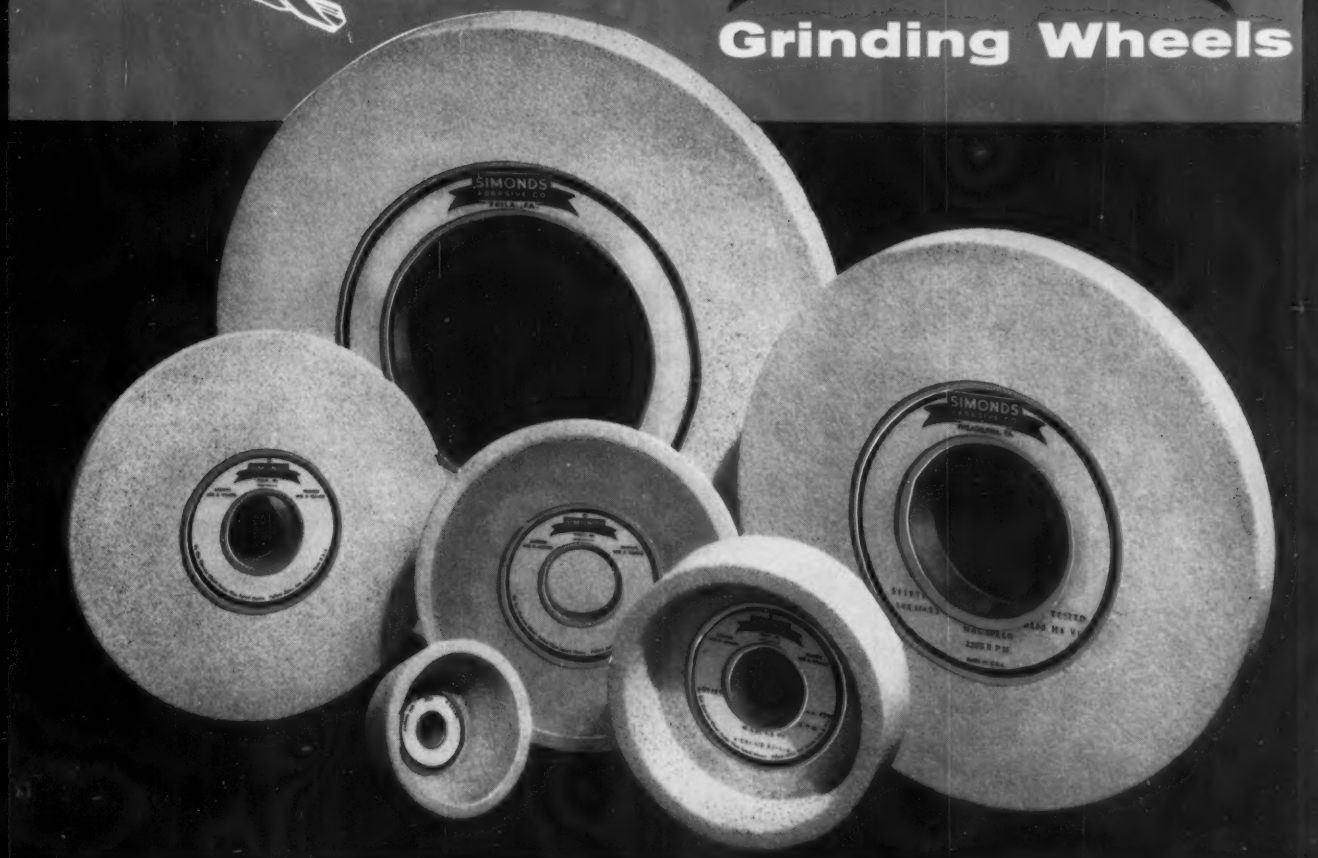
Grinding Wheels



W Borolon® White Wheels

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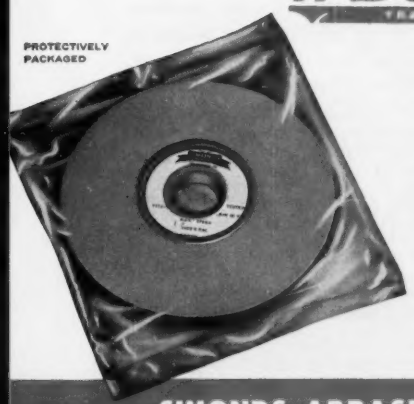

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

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Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
H. P. Townsend Mfg. Co., Elmwood, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bausch Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 334)

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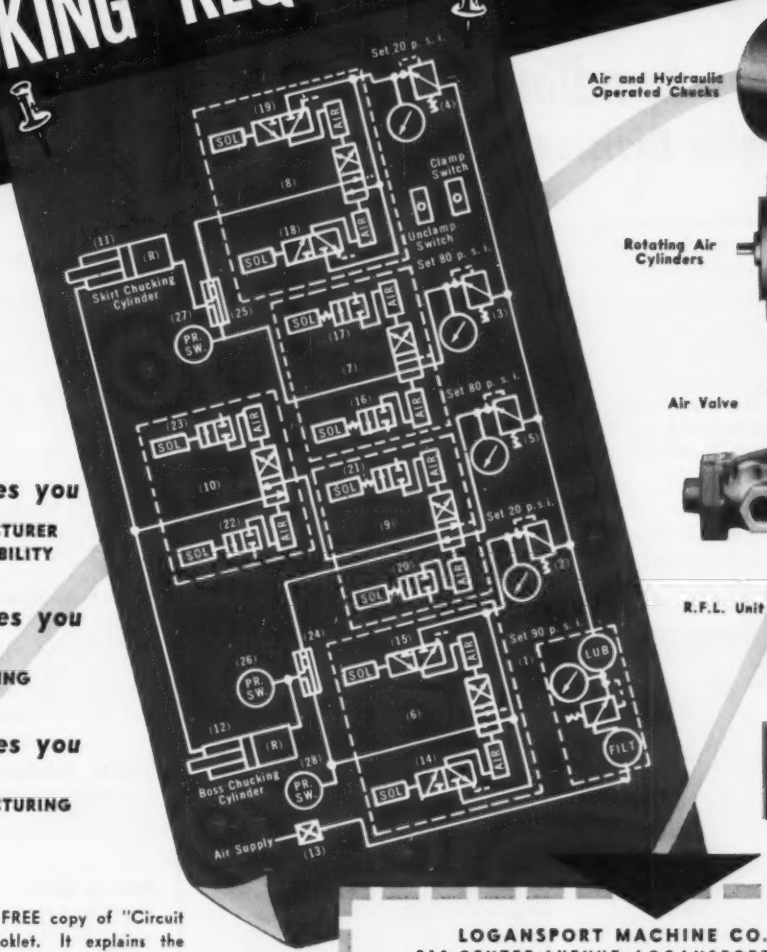
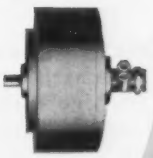
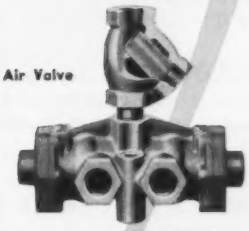


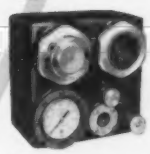
Air and Hydraulic Operated Chucks



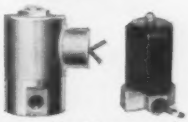
Rotating Air Cylinders



Air Valve



R.F.L. Unit



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- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
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COMPANY _____

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solves handling problem for Permaglas Division, A. O. Smith Corp.

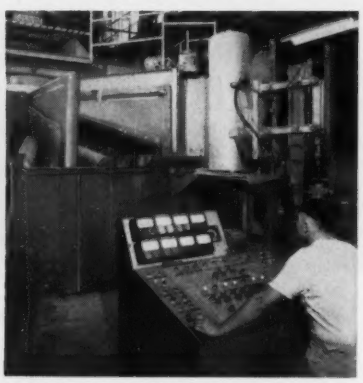
PROBLEM: To automatically unload water heater shells from cleaning machine without damaging shell surface prepared for glass coating. Only upper half of shell periphery is accessible.

SOLUTION: Hanchett Magna-Lock chucks on unloading machine designed and built by Permaglas Division's engineers.

RESULT: Fast, automatic handling. No damage to shell surface.

1. Unloading mechanism positions Magna-Lock chuck above shell. Chuck is energized, pulling shell against chuck's V-face.

2. Held firmly by chuck, shell is lifted from cleaning machine and raised to vertical position.



3. Chuck is de-energized, releasing shell. Air-actuated plungers push shell away from chuck. Shell is transferred automatically to next operation.

If you have a difficult handling or transfer problem Hanchett Magna-Lock electro-magnetic chucks may offer a practical solution. Tell us your problem. Write Dept. M-36.

Hanchett MAGNA-LOCK CORPORATION
Magna-Lock
Magnetic Chucks and Devices
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DRILLS Center
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL, Core
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Rachet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland
Ace Drill Corp., Adrian, Michigan.
Mohawk Tools, Inc., 910 E. Main St., Mont-pelier, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
(Continued on page 336)

NOW! THOR INCREASES POWER OF NEW AIR GRINDER

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THOR'S new 7½ pound vertical air grinder is more powerful, more versatile. It can save time and money in your operation. Check these features to see how:

Completely streamlined, one piece housing encloses everything but spindle and sanding disc or cup for easier, safer handling.

Available at three basic speeds—4500, 6000, or 8000 r.p.m's.

All models supplied with four position throttle for operator convenience.

Can accommodate sanding discs up to 9" diameter, depressed center wheels up to 7" diameter, cup wheels and wire brushes up to 6" diameter.

Handles spaced at 110 degree angle to facilitate operator handling, lessen fatigue.

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9" sanding disc

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Penna.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

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ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS

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EMERY WHEELS

See Grinding Wheels

END MILLS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

(*Continued on page* 340)

Talking About Die Sets

with

Phil Marsilius

Vice-President
The Producto Machine Co.

"Tooling for Tomorrow"—This month's ASTE Exposition in Chicago offers you an opportunity to find out whether your tooling practices and facilities are keeping pace with the many technological advances being made throughout industry. You will be able to see the latest tooling developments on display in more than 450 exhibits.

Major die set advances have been made since the last Tool Show and many of the leading die set manufacturers will be exhibiting them at the International Amphitheatre. "Tooling for Tomorrow" includes radical changes in the design, appearance, performance and accuracy of die sets and their components; new lubrication methods; and numerous new die accessories. The Tool Show is a rare occasion for you to inspect, compare and select the developments best suited to your particular die set requirements.

Related diemaking equipment, of course, will be displayed along with thousands of other products intended to improve your manufacturing operations. The editorial pages of this magazine give you an excellent preview of some of the outstanding tools, machines, materials and processes to be demonstrated for the first time in Chicago on March 19-23.

You will also want to attend a number of the ASTE technical sessions. Such vital topics as "Plastic Tooling Challenges the Tool Engineer" and "Solving Carbide Die Problems" are on the well-balanced program. And you can choose from 12 conducted tours to plants in the Chicago area.

If you have not yet made plans to attend the ASTE Exposition, we urge you to do so. We cordially invite you to stop at Booth 396 for a personal chat about die sets.

Try Our "Blindfold Test" at the Show and See How:

PRODUCTO'S NEW DIE SET CAN ASSEMBLE ITSELF!

Yes, it's true. An ingenious guide pin design feature, new and exclusive with Producto, enables the die set to practically assemble itself. You can test it in Booth 396 at the ASTE Show in Chicago. *We guarantee you will be able to assemble the set blindfolded ...using just one hand!*

This is a real boon to the man on the bench. For him, a Producto die set means no more fussing to line up pins and bushings...no more need to hammer punch holder down on pins. He can start the punch holder on straight or at any angle...*and the die set puts itself together.* It never cocks, never jams.

While this new feature is special to a particular line of pins—available from all Producto warehouses soon after the Show—*all* Producto guide pins have been improved with greater press fit lengths, smoother end radii and mirror-like surface finish of 7-9 micro-inches.

Producto's new pins and new bushings* are added reasons you should call your nearest Producto branch for precision die sets...fast. Be sure to see these important developments in Booth 396 at the ASTE Show.

**Featured in current* Die Set Digest *with other valuable data for the diemaker and user. Write today for your free copy.*

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985 Housatonic Avenue, Bridgeport 1, Connecticut
Telephone: FOrest 7-8675

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Chicago	ES 8-3307	Kansas City	BA 9033	Philadelphia	MO 4-1010
Cleveland	SU 1-6158	Los Angeles	TR 9826	Rochester	GL 1810, GL 5357
Dayton	MU 1651	New York	WO 4-7484	St. Louis	FR 1-3370

or check Yellow Pages in any other stamping center for distributors stocking PRODUCTO.

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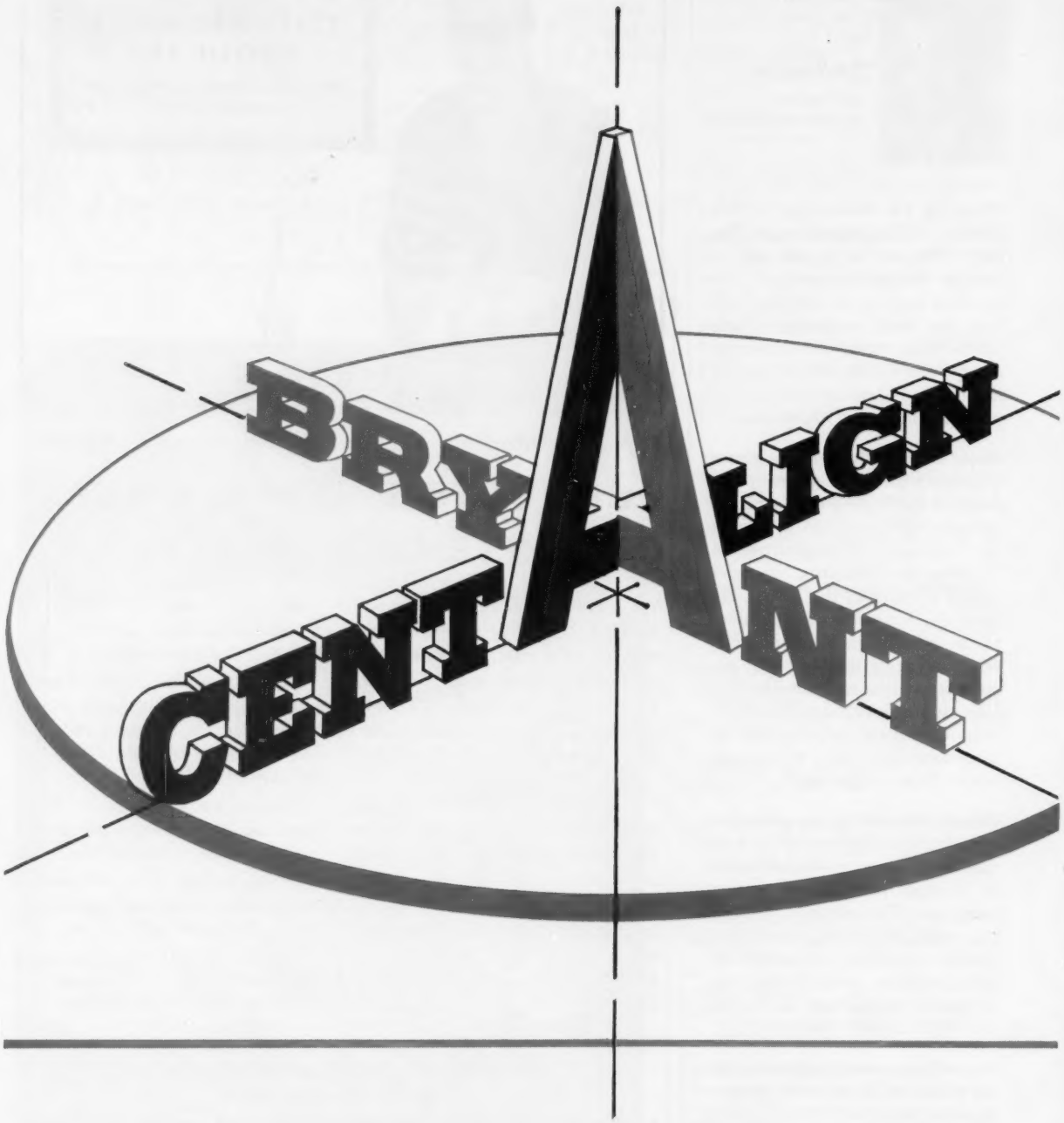
Precision Die Sets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FINISHES FOR MACHINE AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FORGINGS, Machines (Upsetting)
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Gerrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Mahon, R. C. Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating
Ajax Electric Company, Philadelphia, Pa.
General Electric Co., Schenectady 5, N. Y.

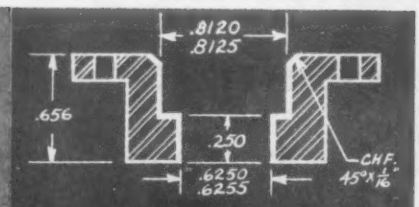
FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co. Woonsocket, R. I.

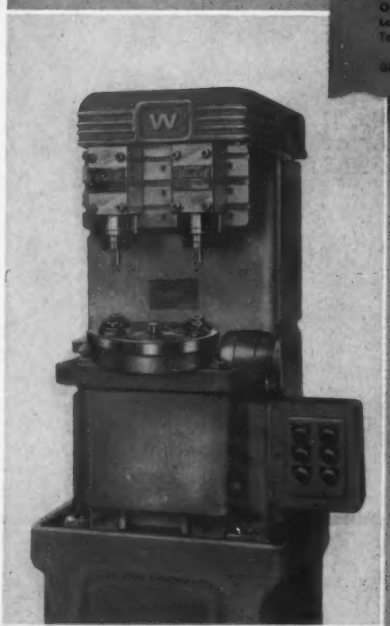
GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(*Continued on page* 344)

600 pieces per hour



A typical example of the productive capacity of this machine:
MATERIAL - cast iron.
Operation performed face drg. above.
Loading and Unloading - Manual.
Tooling: Automatic positioning table. Diaphragm type chucks.
GROSS PRODUCTION - 600 pieces per hour.

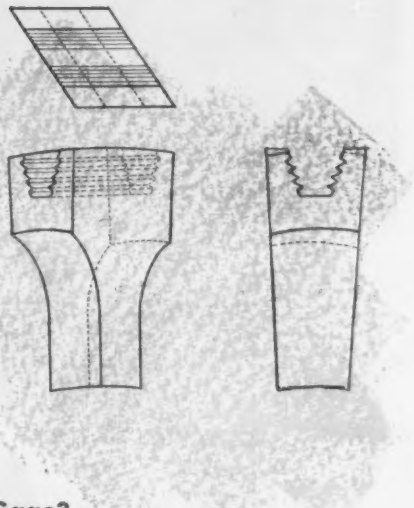


WADELL
PRECISION VERTICAL
boring machine
High production capacity at a total investment of
$6,925 completely tooled
features:
• Automatic Cycle • Space Saver Design
• Low Initial Cost • Ease of Loading

WADELL TOOLING SERVICE
Wadell engineering and facilities provide the user a "PRODUCTION PACKAGE" completely prepared to perform machining operations.
Precision boring spindles of the highest quality, ball and roller bearings; rotary positioning tables, and diaphragm chucks are available as standard accessories. All special tooling; such as fixtures, boring bars and other required tooling is designed and built to complete the "PRODUCTION PACKAGE".
Forward your drawings to Wadell and get "Production Package" cost.

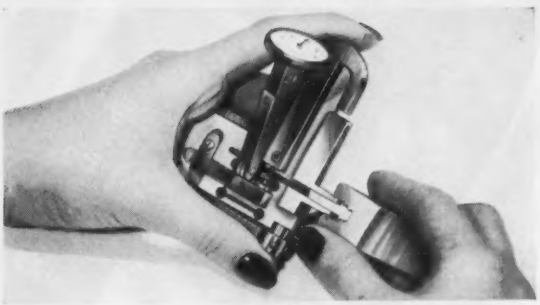
write for literature:
WADELL EQUIPMENT CO.
119 South Avenue • Garwood, N. J.

WHICH GAGE WOULD YOU USE TO INSPECT THIS PART?



An Air Gage?

An Air Gage *can* be used to gage the serrations in this insert for turbine blades. However, had the manufacturer set up to check this part with Air Gages, he would have invested $5,500.00 more than was required.



A Dial Indicator Gage?

A dial Indicator Gage, specially modified for the work, proved the economical, right answer. **Thirty-nine** of these gages are used to assure that the dimensions of the "Christmas tree" form are held to exact size. Fast and simple, this gage fulfilled all requirements for accuracy and it cost far less because an inexpensive Dial Indicator was used instead of a much higher priced Air Gage.

Most workpieces can be gaged in a number of ways. A manufacturer of Air Gages exclusively will tell you that the gaging should be done by air and that **his** gage is the one you should buy. On the other hand, a manufacturer who makes only Dial Indicators will view the job in terms of Dial Indicators and will hope to sell you **his** gage to do the work. Usually there is **one** method which is clearly best for a given job and you cannot be sure of getting the best gage if you approach for recommendations a manufacturer who makes and sells only one kind of gage.

Since Federal makes all modern gaging systems, we can be impartial in our recommendations and supply you with whichever system best meets your needs.

Our specialized background of continuous and extended experience in gaging has taught us to analyze and solve gaging problems with certainty and to render sound service to our customers.

There is a Federal representative near you, ready to give you the facts impartially. He is unbiased and will recommend the **best** gage for your work. Write or call us today.

Federal Products Corporation
6113 Eddy Street, Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

Federal's Solution to the Cost of Gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

See also next pages →

For more information fill in page number on Inquiry Card, on page 255

SEE ALSO PRECEDING PAGE

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

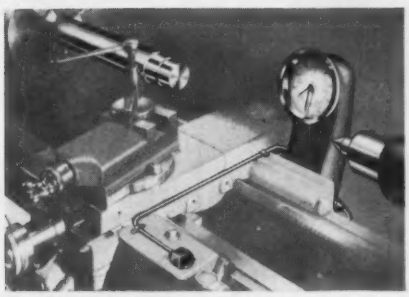
A LIFETIME DIAL INDICATOR

At the ASTE Show (Booth 496)

with the maintenance-free "H" Movement

Rugged—shockproof—withstands impact without damage. No cushion movement required. **All gears, racks, and pinions precision hardened** — friction reduced 16% to 25%, depending upon magnification . . . a new high in sensitivity. Calibrated accuracy greatly improved. Off-white dials and fine line graduations facilitate readings. Available in four sizes. Enthusiastically received in shop tests.

Also, a New Machine Tool Gage—the DISTOMETER



Illustrated with tail stock backed off.

A long range indicating device for accurately determining tool position with relation to a predetermined reference. It indicates to the operator (within .0025") when the cutting tool has covered the required distance on the workpiece. Provides much-needed machine control for repeat operations, when roughing down to size, particularly where the tool travel is long. Can be readily located on any machine tool carriage regardless of table travel. It eliminates scrap, increases machine productivity and maintains dimensional quality.

Federal's Solution to the Cost of Gaging . . .
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

We will be glad to tell you more. Write today.

FEDERAL PRODUCTS CORPORATION
6113 Eddy Street • Providence 1, R. I.

For more information fill in page number on Inquiry Card, on page 255

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Winter Bros. Co., Rochester, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 17, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Winter Bros. Co., Rochester, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(*Continued on page* 348)

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SUPER-PRECISION Spindles LEAD THE WAY IN INDUSTRY!

STANDARD Super-Precision Spindles represent the ultimate in rugged construction, trouble-free maintenance and adaptability. In use on a thousand jobs in industry the nation over. Every Standard spindle is "checked out" electronically in our sound-, vibration-, dust-proof laboratory before approved for delivery. Write today for catalog.

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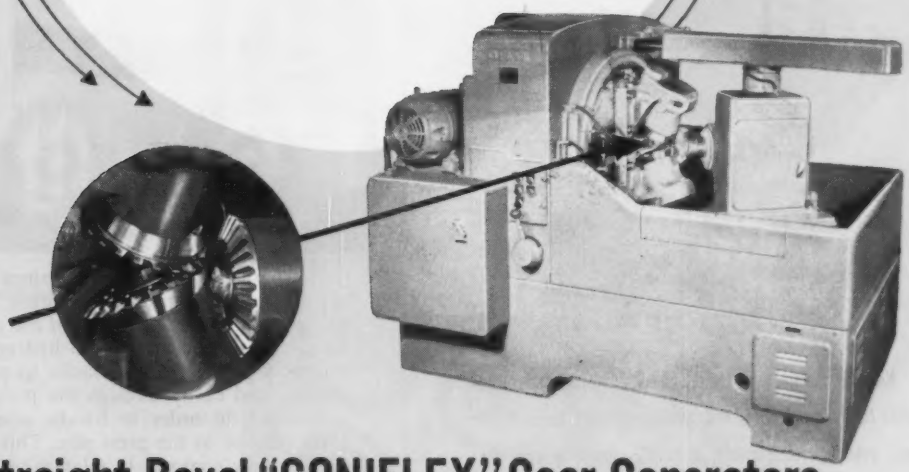
the STANDARD electrical tool co.
SUPER-PRECISION SPINDLE DIVISION
2500 RIVER RD. • CINCINNATI 4, OHIO

Something New at ILLINOIS GEAR



In Straight Bevel "CONIFLEX" Gear Generators

It's a great new improvement in bevel gear generators. It's here now, at Illinois Gear, ready to work on your gear orders.

It's another step forward at Illinois Gear—more fine, new machine tools added to our ever expanding production facilities to give you faster service and finer quality. Installing the finest in new and improved equipment is a constant activity at Illinois Gear. It is in keeping with our policy of being "first with the finest." Send your next gear order to Illinois Gear—get the utmost in service and quality.

Look for this mark ILL® . . . the symbol on finer gears

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Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

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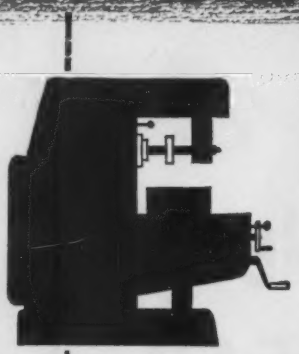
production begins with



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Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 46 years.

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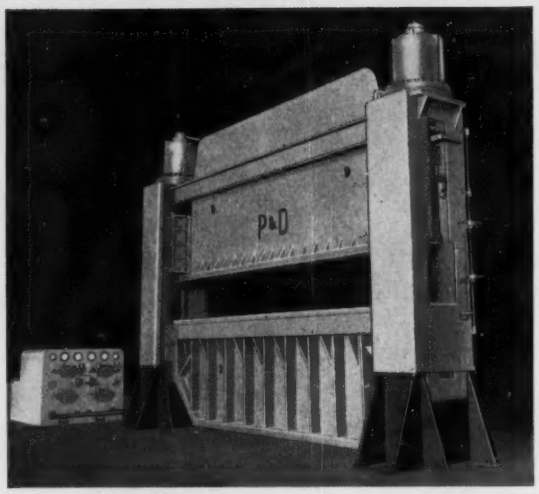
ESTABLISHED 1906
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

Complete Length of pressing surface is USABLE on new 1000-Ton HYDRAULIC PRESS — by Philips & Davies



Completely open end-housings permit passage of work through the press, up to and exceeding the *overall length of the pressing surface* — in this new 1000-ton hydraulic press by Philips & Davies. All obstacles to passing work quickly and easily through the press have been eliminated, in order to handle unusually large work relative to the press size. This unique unit is extremely compact in relation to its 1000-ton rating, with an overall length of 26′1″, width 4′6″ and height from floor 16′5½″. Heavy steel plate up to ⅞″ thick x 19′ long can be processed.

By re-arrangements within the pumping units, four different ram speeds can be provided, with a wide variation of working cycles. All units are furnished with a completely automatic and extremely sensitive ram-leveling device, as well as a ram-tilt feature. This unit is adaptable to many pressing operations such as forming, blanking, bending, straightening, drawing, etc. Various other models of these hydraulic presses are available, ranging in capacities from 500 to 2000 tons, and lengths from 6′ to 30′ — with operation characteristics basically the same as the 1000-ton model.

p&d

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QUALITY HEAVY MACHINERY SINCE 1877

PHILIPS & DAVIES, INC.
Kenton, Ohio

Forst

Broaching Machines

with low pressure, hydraulic gear, horizontal and vertical types for internal and surface broaching; pulling capacity:
up to abt. 62 tons
Maximum stroke:
vertical types = 79 ins.
horizontal types = 138 ins.

Broach Sharpening Machines

for circular shaped and slab broaches.
Max. length of tools 31,5 ins. and 59 ins.

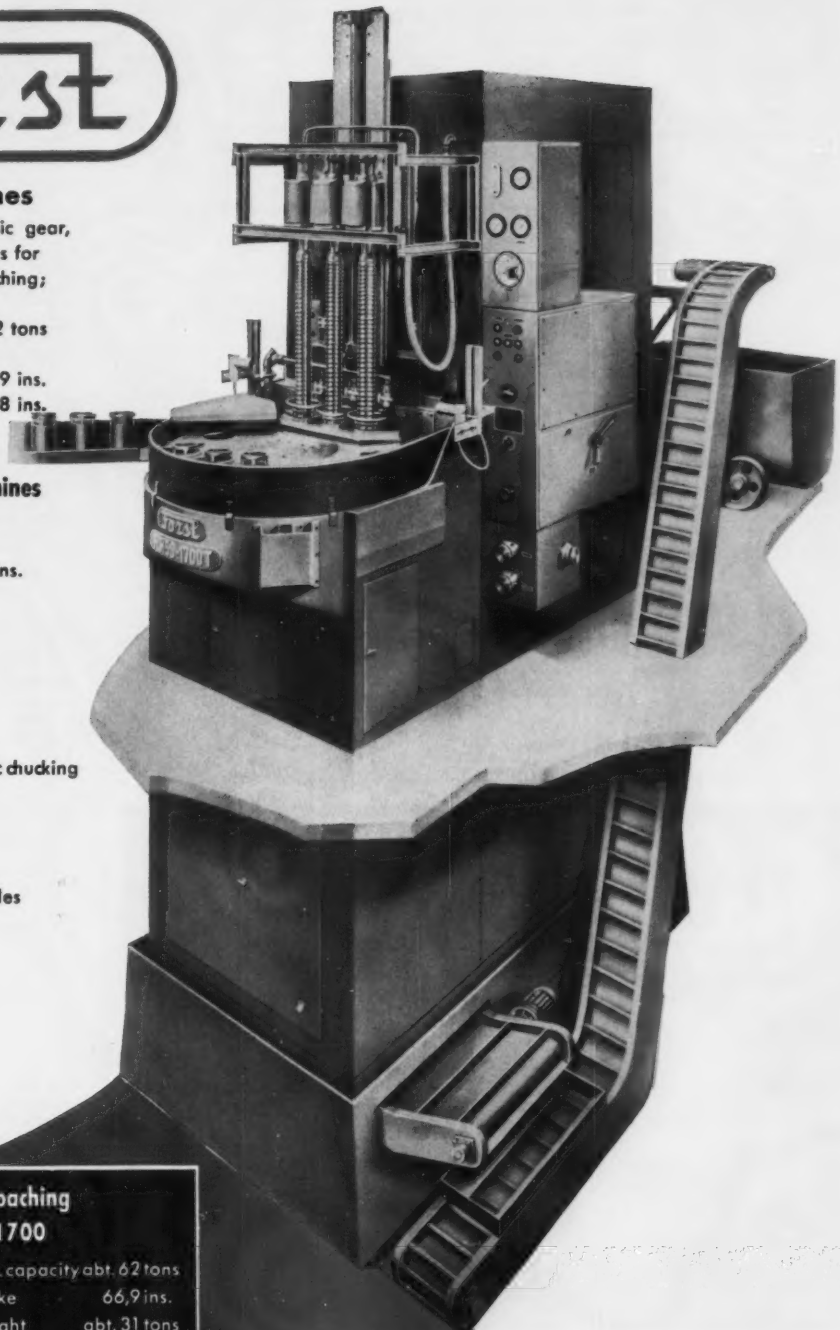
Broaches

Fixtures

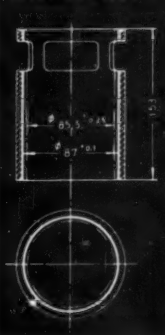
for mechanical and hydraulic chucking

Gages

for checking broached profiles



Vertical Internal Broaching Machine RSI - 56/1700



Max. capacity abt. 62 tons
Stroke 66,9 ins.
Weight abt. 31 tons
set up for broaching starter housings; rolled material
Cutting speed:
abt. 26 ft / min.
Duration of a working cycle abt. 30 secs.
Further details on demand

OSWALD FORST G·M·B·H
SOLINGEN
GERMANY
U. S. Representative:
KURT ORBAN CO., INC.
34 Exchange Place
Jersey City, N. J.

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schless Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd. Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

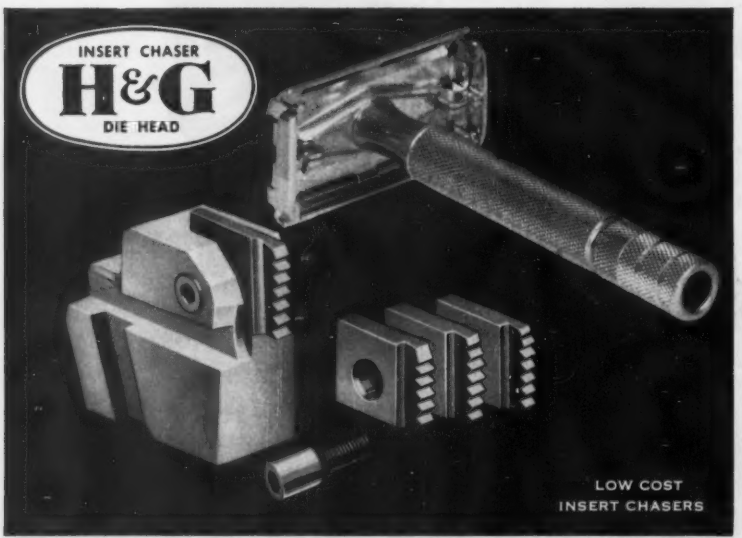
GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Bausch Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks, 1309 So. Cicero Ave., Chicago 50, Ill.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(*Continued on page 350*)



FOR LESS THAN $40 YOU GET 12 SETS, EACH SET GROUND READY TO GO

Men would not accept either idea at first . . .

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Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $40 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.
FREE: "Unified and American Screw Thread Digest."

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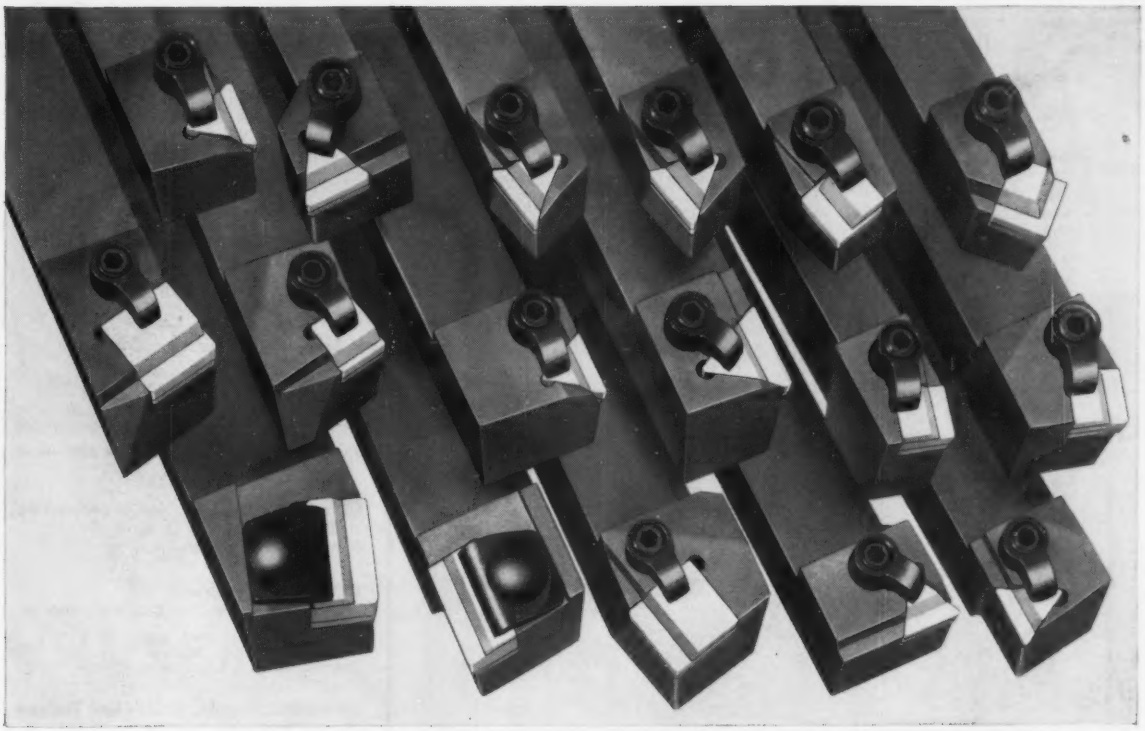

17 Kendex† holder styles and 101 different tools

KENNAMETAL* today offers the tooling for tomorrow

Kendex Button and Heavy Duty tools can truly be considered as the "Tooling for Tomorrow."

Kendex holders are simple and rugged in construction; fitted with trouble-free, interchangeable "hardware"; accommodate square, round and triangular turnover, throw-away button inserts that eliminate costly grinding . . . all features needed to keep tomorrow's high speed, highly synchronized production lines on the go—hour after hour.

"Tooling for Tomorrow" must face up to varied cutting jobs, on many types of machines . . . machines that will require quick, accurate tool changing for close tolerance work at high speeds and low costs per piece. Kendex tooling was designed for such conditions. In addition, it increases efficiency; lowers tool investments; sharply reduces maintenance costs. There are over 100 Kendex tools and 35 different Kendex inserts—some stocked in as many as six Kennametal grades.

Why not have a Kennametal tool engineer help you step up efficiency on today's jobs with Kendex "tooling for tomorrow." He works exclusively with Kennametal tooling . . . applying and servicing it. This specialized experience is yours for the asking. KENNAMETAL INC., Latrobe, Pennsylvania.

Eleven Kennametal Grades . . . To Give You Top Performance

No matter how versatile or rugged the toolholder—final performance depends on the cutting edge. Here's where hard, uniform, dependable Kennametal blanks and inserts will pay off on your operations—regardless of the job or machine. With eleven grades to select from, you can get top performance on every cutting job.

Try Grade K21, the ideal general purpose steel cutting grade that is outperforming all other general purpose carbides, and its companion . . . Grade K5H . . . a hard crater-resistant grade for finish machining at high speeds. Kennametal's simplified grade selection system makes it easy to get the right grade on every job.

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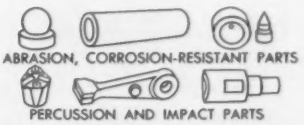

For more information fill in page number on Inquiry Card, on page 255

New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Stamped
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric
General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool
See Grinding Mches., Carbide Tool

GRINDERS, Die and Mold
Consolidated Mch. Tool Corp., Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools
Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Illinois

GRINDERS, Portable Electric and Toolpost
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thor Power Tool Co., Aurora, Illinois

GRINDING FIXTURES
Geometric Tool Co., (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(Continued on page 352)

"Doc! It's like fighting DERMATITIS with an armored glove."

Except WEST *protective gloves* are invisible.

— quickly applied
— comfortable to wear
— easily washed away.

For skin exposed to oils, dust, grease and grime:
— use PROTECTIVE CREAM #211.

For skin exposed to acids, alkalies and inorganic chemicals:
— use PROTECTIVE CREAM #311.

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— use PROTECTIVE CREAM #411.

WEST PROTECTIVE CREAMS protect against hundreds of troublesome industrial irritants.

Too, they're antiseptic. Inhibit harmful bacteria with Hexachlorophene. And most important, they protect *for extended periods of time.*

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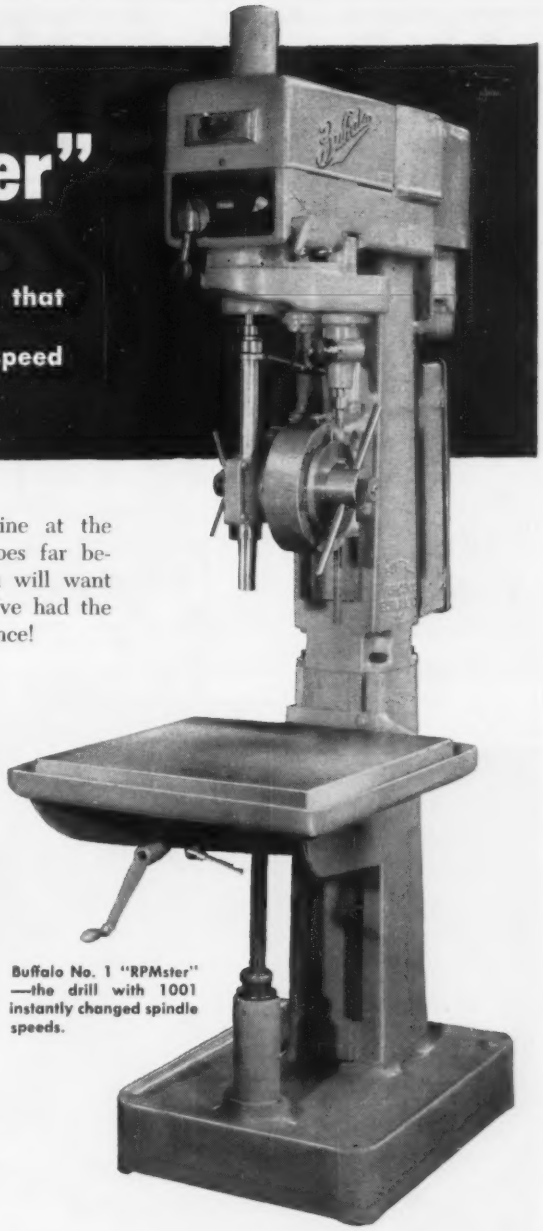
You Have to Operate
THE NEW "RPMster"
to Believe It!

- . . . So perfectly balanced and fitted that it's vibrationless!
- . . . So smooth in feed and spindle speed adjustment!
- . . . So responsive to your commands!



Those who saw this great new drilling machine at the NMTBA Show will verify it. The "RPMster" goes far beyond the ordinary concept of a "drillpress". You will want to have one or more working for you, after you've had the experience of operating one—and it is an experience!

First, its gearless drive and perfectly fitted spindle provide extreme smoothness and quietness of operation.

Second, you can instantly get any low range spindle speed from 100 to 550 R.P.M.s at the touch of a lever—and, by switching to high range in a few seconds, any speed from 500 to 3000 R.P.M.s. Here is the really versatile machine for smooth work flow through the wide range of drilling, reaming and tapping operations.

And as the "Buffalo" power feed obeys your touch, you know you're completely in command of this powerful 88" high machine. The "RPMster" lives up in every way to the "Buffalo" "Q" Factor* standard of performance.

Your nearby "Buffalo" representative will be glad to arrange a demonstration, or write us.

Buffalo No. 1 "RPMster" —the drill with 1001 instantly changed spindle speeds.

*The "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.

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BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

For more information fill in page number on Inquiry Card, on page 255

GRINDING MACHINES, Carbide Tool

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Rooseveit Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

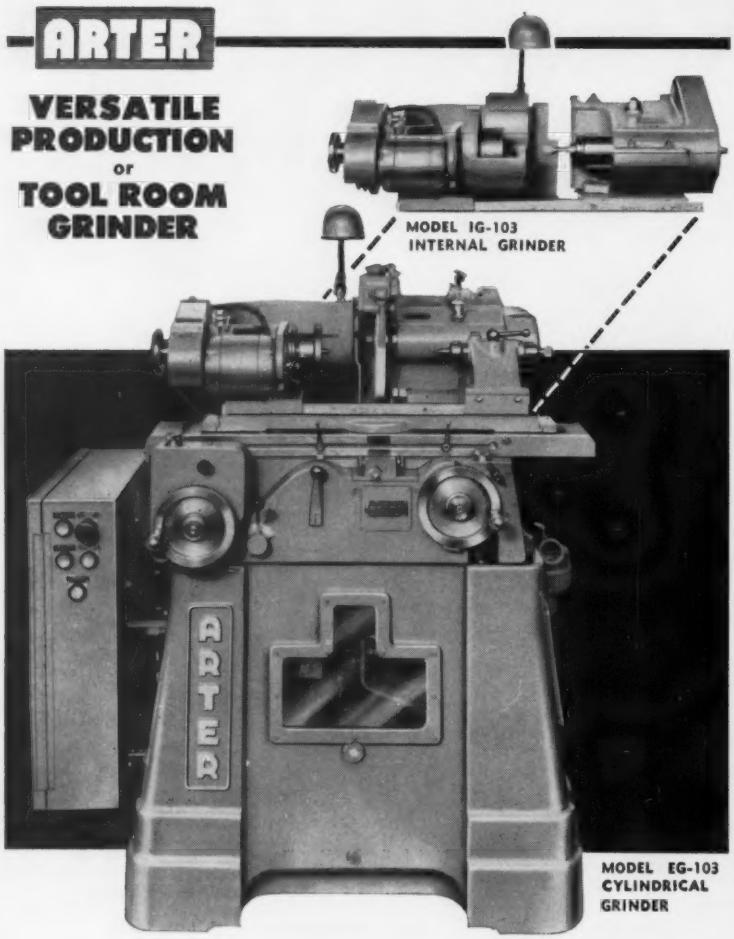
Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

ARTER

VERSATILE PRODUCTION or TOOL ROOM GRINDER



Arter's dual purpose grinder — Internal Grinder or Plain Cylindrical Grinder by simply changing wheelheads. This relatively low-priced grinder, designed for tool room or production work where small-in-capacity machine is needed, can be used as prime equipment or as an auxiliary to larger machines.

ARTER GRINDING MACHINE COMPANY
WORCESTER 5, MASSACHUSETTS
Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders
AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

GRINDING MACHINES, Cylindrical

Arter Grinding Mch Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Face

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

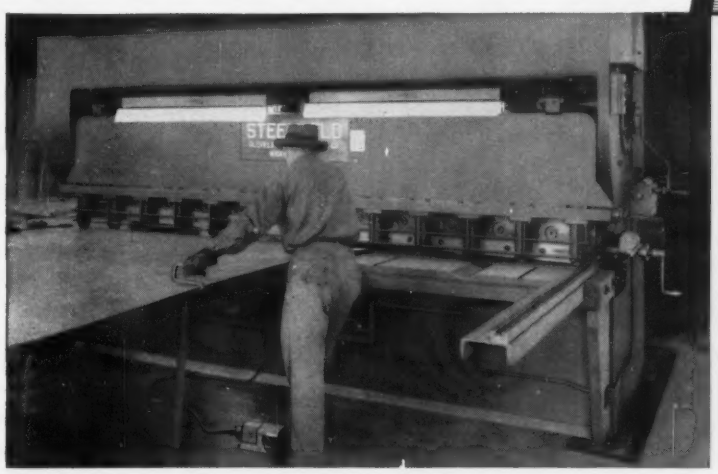
GRINDING MACHINES, For Sharpening Turning and Planing Tools

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

(*Continued on page 354*)

TOE CONTROL ELIMINATES KNEE ACTION

ELECTRIC FOOT SWITCH REDUCES FATIGUE - SPEEDS SHEARING



● The operator can slide the switch around the floor to wherever handiest to use. A mere touch of the toe and the knife is set in motion. Electric toe control is standard on all Steelweld Shears and furnished at no extra cost. It enables shearing speeds not attainable with ordinary foot treadles for many cutting operations.

● If you have spent a day at a shear with the old mechanical foot treadle, you know what knee action is. As the hours roll by it grows more and more tiresome, fatiguing, and production slips accordingly.

At last something has been done about it. Electric foot switches have been adopted as standard equipment for Steelweld Shears. Knee action has been replaced by fast easy toe control.

Toe control is one of many outstanding features you get on Steelweld Shears. These machines are in a class by themselves. Learn what they can do for you.

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CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Internal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2448-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co. Inc., West Hartford, Conn.

GRINDING MACHINES, Knife and Shear Blade

Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

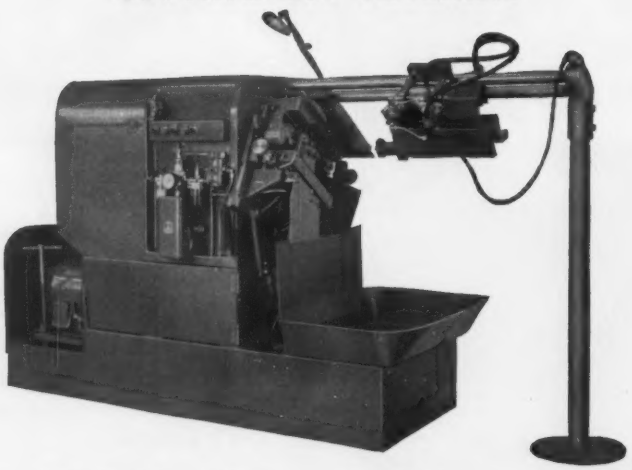
GRINDING MACHINES, Surface

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S.. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

The MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

WRITE FOR ILLUSTRATED CATALOG

MODERN MACHINE TOOL CO.
Jackson, Michigan

GRINDING MACHINES, Thread
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Mannasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal
Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

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Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric
Millers Falls Co., Greenfield, Mass.
Thor Power Tool Co., Aurora, Illinois

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Shaft
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES
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Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

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(*Continued on page 356*)

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Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio

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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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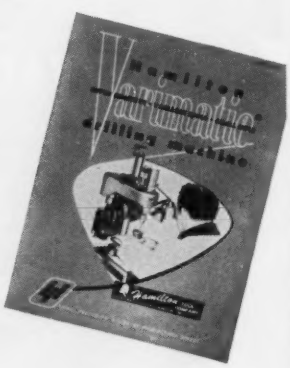

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(Continued on page 358)

5410

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(*Continued on page 360*)

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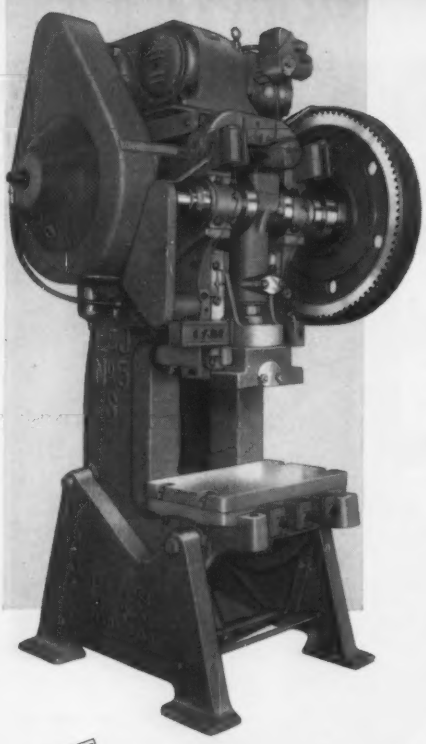
Keeps Production Efficient



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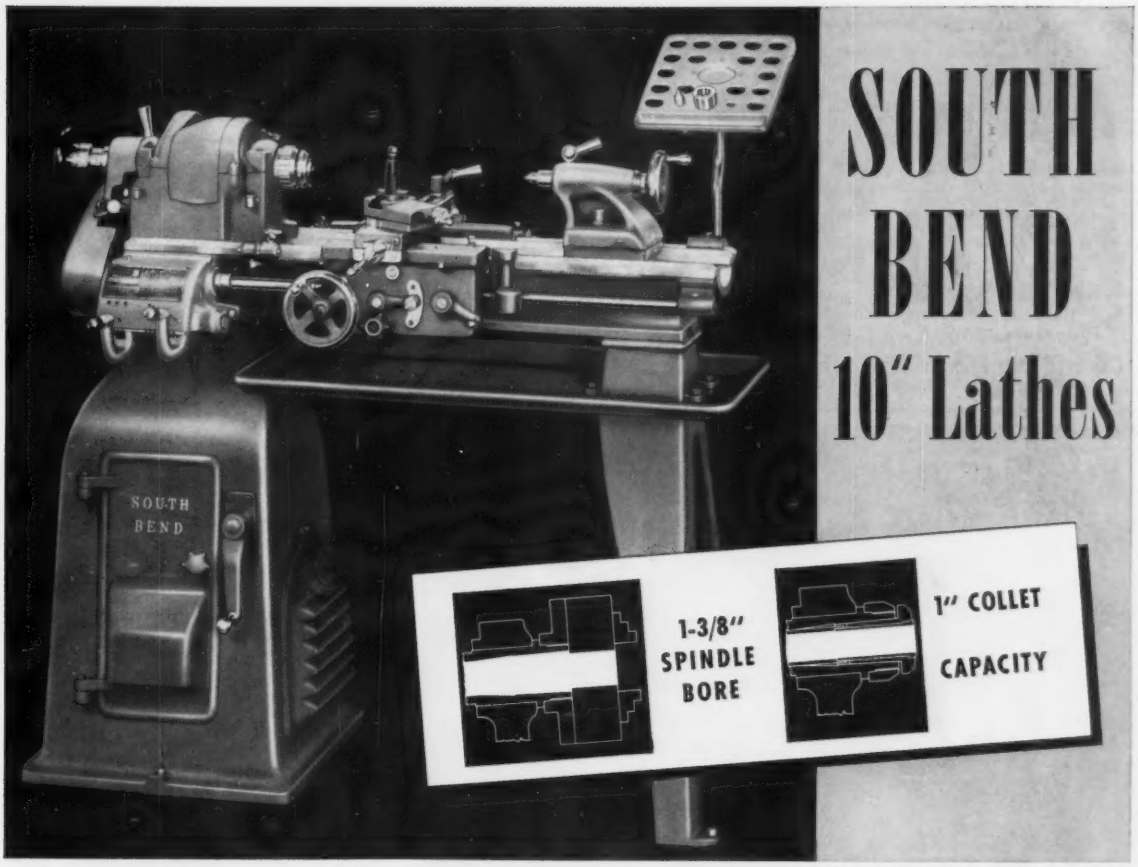

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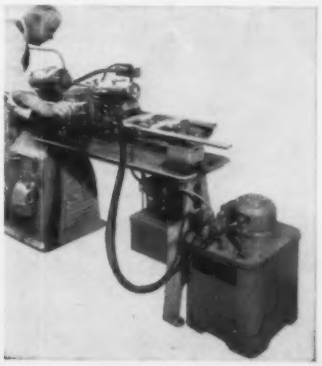

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COLLET CAPACITY.....1 in.
SPINDLE BORE.....1⅜ in.
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Over 50 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.
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Pratt & Whitney Co. Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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See Recording Instruments

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis
Pratt & Whitney Co. Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

(*Continued on page 362*)

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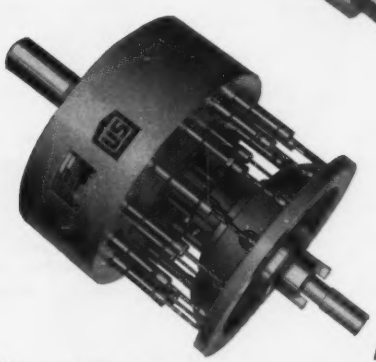
For semi-automatic setup.



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Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Ingersoll Milling Mch Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sunstrand Mch.. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 29, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

(*Continued on page 364*)

at rates up to 288 per hour

Five Burr-Blast models available — manually loaded stationary or continuous rotating units and fully automatic in-line types—permit you to pick the right type and size machine to remove fragmentary burrs from finish machined non-ferrous or cast iron parts. Simple installation uses normal plant air supply from 60 to 80 psi. Built-in flexibility permits burring a variety of parts on any of the Burr-Blast models.

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For more information fill in page number on Inquiry Card, on page 255

See why Tool Engineers call these heavy producers,

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Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

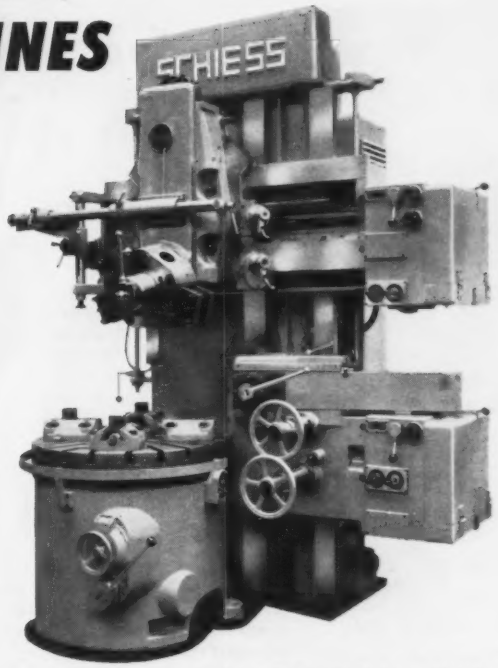
Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

Magnetic dry particle clutch provides vibration-free drive for smooth surface finish. Power is transmitted via belt to clutch from main motor mounted on left side of machine. Instantaneous braking is assured by magnetic dry disc brake.

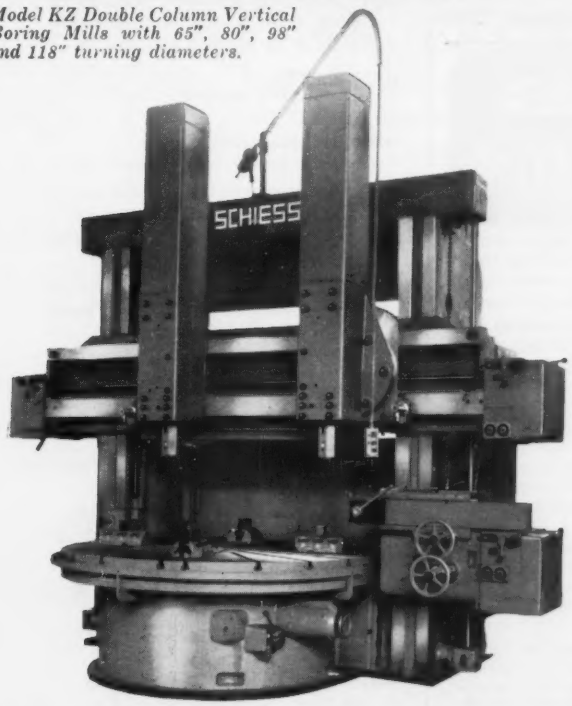
Copying attachment with electric tracer for use on cross rail or side head.

See it tracing tire molds at ASTE Show—Booth 305



Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



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Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table operated by three-button pendant control. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

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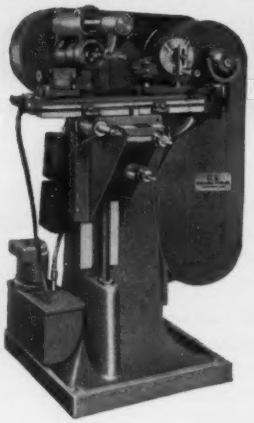

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Pratt & Whitney Co. Inc., West Hartford, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rickford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOTORS, Electric
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NAMEPLATES
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES
Wales-Strippet Corp., North Tonawanda, N. Y.

NICKEL, Alloys
International Nickel Co., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY
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Landis Machine Co., Inc., Waynesboro, Pa.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

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NUT TAPPERS
See Bolt and Nut Machinery.

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Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

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(*Continued on page* 366)

NEW YORK

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Today, top contract tool and die shops often rely on illustrated booklets to sell prospects on their facilities. And they often rely on pictures of their Moore Jig Borers and Jig Grinders to indicate the degree of precision work they can do. It's particularly significant that leading contract shops choose Moore machines for "double duty"—in the toolroom and on the printed page—for these owner-managed firms are understandably deliberate and judicious in selecting machine tools. Write today for detailed bulletins on Moore's top-billed toolroom teammates.

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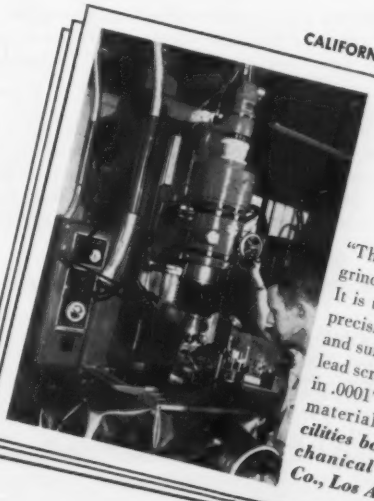

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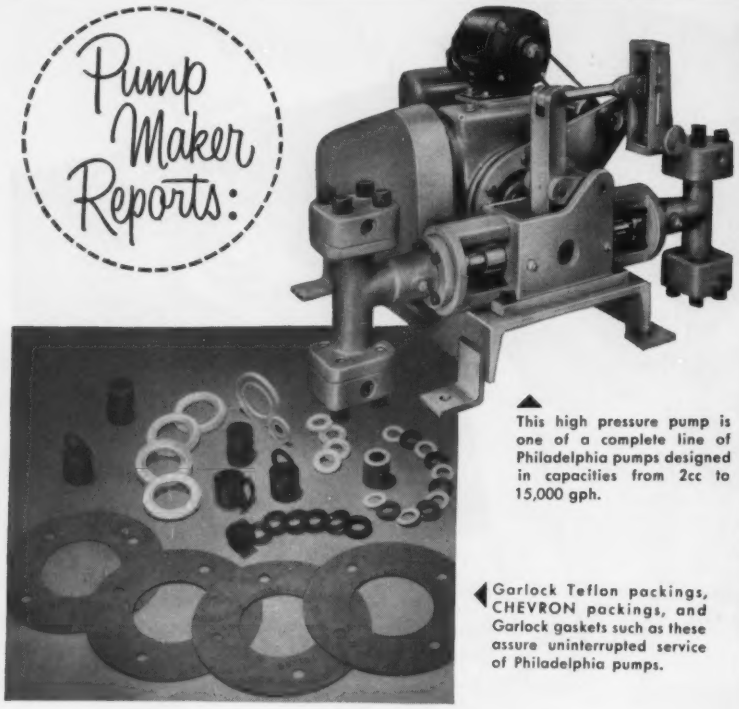

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Shell Oil Co., 50 W. 50th St., New York, N. Y.
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Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
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Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
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Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
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Michigan Drill Head Co., Detroit 34, Mich.
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Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

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Garlock Packing Co., Palmyra, N. Y.
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Lowe Bros. Co., Dayton, Ohio.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 368)

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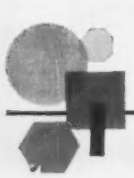


In Canada: Sanderson-Newbould, Ltd., Montreal and Toronto

WHEELOCK, LOVEJOY & COMPANY, INC.

138 Sidney Street, Cambridge 39, Massachusetts

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

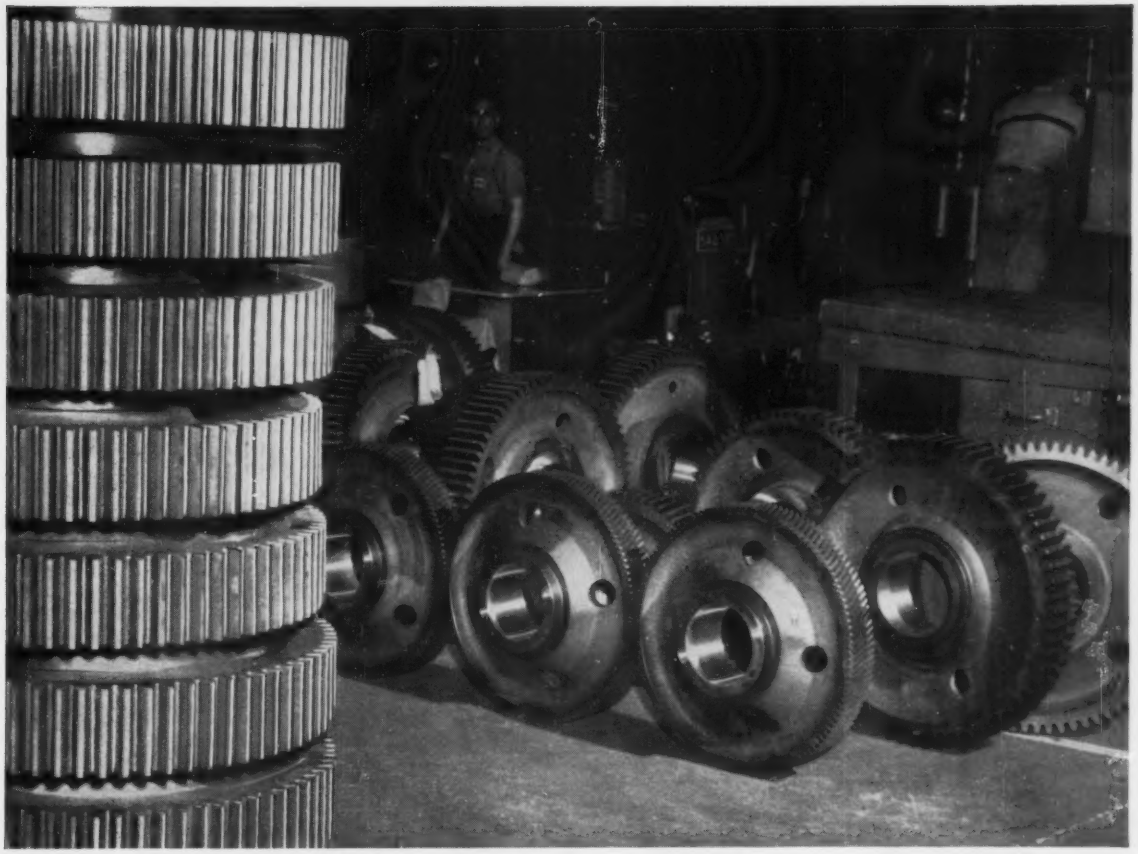
PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Angle
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

PLATES, Surface
Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(Continued on page 370)



The gear shop can be proud of these

To the shopman, few things are prettier than a well-machined gear — unless it's a whole inventory of well-machined gears. The stock above is a good example.

Here the beauty is more than skin-deep. The gears are as strong and tough as human skills can make them. All these gears were machined from Bethlehem blanks, which meant that they started with every advantage.

After all, the basis of any good gear is a good, sound blank. And you are certain of top-flight blanks when you get them from Bethlehem. For, at the Bethlehem shops, a special process has been developed for the making of gear blanks; a process that assures high strength, uniform grain flow, and excellent surface texture.

This method of manufacture is unique. It employs the only mill of its kind in the country . . . a mill that upsets, forges, and rolls the steel in a single operation. Let's stress that point. The blank is not just forged, not just rolled, but *both* . . . and both are important to the quality of the finished piece.

You're interested in quality, we know. So specify Bethlehem blanks for your spur, bevel, miter, helical, and other types of gears. You'll find these blanks equally good for crane wheels, industrial wheels, turbine rotors, clutch and brake drums, sheave wheels, flywheels, etc. They are available in sizes from 10 to 42 in. OD.

For additional information, ask us to send you Booklet 216. It is crammed with pictures and interesting data. No charge, of course; just drop us a card.

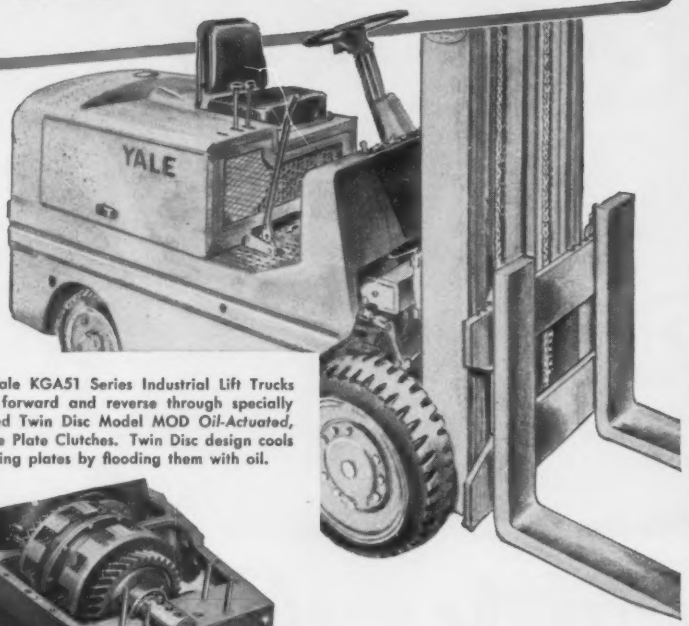
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

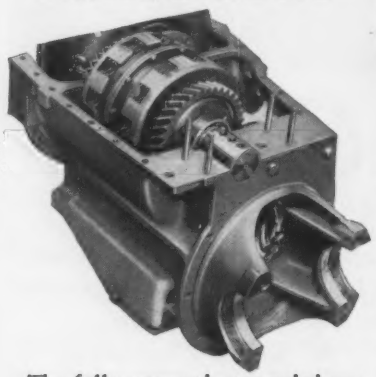
BETHLEHEM STEEL

BETHLEHEM STEEL

Forward and reverse on new Yale KGA51 Series obtained by specially designed *TWIN DISC CLUTCHES*



New Yale KGA51 Series Industrial Lift Trucks obtain forward and reverse through specially designed Twin Disc Model MOD *Oil-Actuated*, Multiple Plate Clutches. Twin Disc design cools driving plates by flooding them with oil.



The fully automatic transmissions in the new Yale KGA51 Series Industrial Lift Trucks obtain forward and reverse motion through specially designed Twin Disc Model MOD *Oil-Actuated,* Multiple Plate Clutches.

Because of the severe energy cycle of the vehicle, a specific clutch for finger-tip control was required. Twin Disc Engineers *worked closely* with the manufacturer in developing such a clutch. In the special Twin Disc design, oil is pumped through the shaft and cools the driving plates *by flooding them with oil.* Sintered friction material is also used, because of the high energy loading.

If you have a specific power linkage problem, on your powered equipment, consult Twin Disc Specialists . . . ask them to assign you a project engineer. Twin Disc Clutch Company, Racine, Wisconsin.

TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin - HYDRAULIC DIVISION, Rockford, Illinois

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PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488 90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnatti, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

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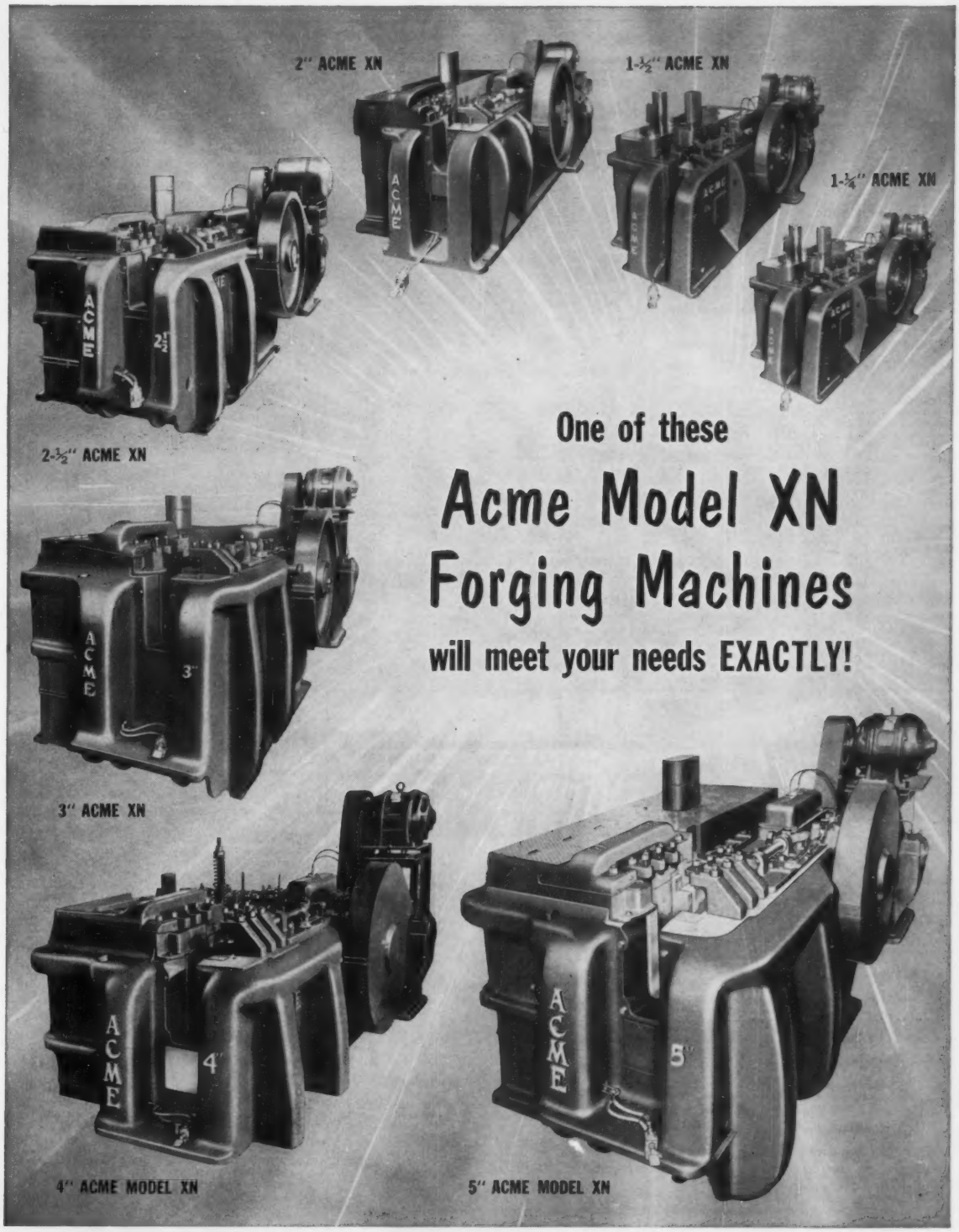

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ACME MACHINERY DIVISION • 1203 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

For more information fill in page number on Inquiry Card, on page 255

Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Mchy. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Brooch & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. &Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Philips and Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton Ohio.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

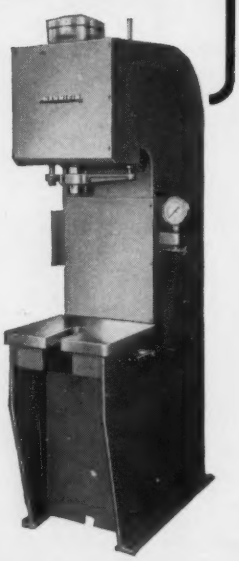
Allen, Alva F., Box 426, Clinton, Mo. (Bench
American Steel Foundries, Elmes Engrg. Div. Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div. Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio
Cleveland Punch & Shear Works Co., 3917 St Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y
Dake Corp., 604 Seventh St., Grand Haven Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Aves., Philidalphia, Pa.
Famco Machine Co., 3134 Sheridon Rd. Kenosha, Wis.
Federal Machine & Welder Co., Overland Ave. Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Johnson Machine & Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div. Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St. Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa
Colonial Broach & Machine Co., P. O. Box 37 Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y
Dake Corp., 604 Seventh St., Grand Haven Mich.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1 N. Y.
Niagara Machine & Tool Works (Hydraulic) 683 Northland Ave., Buffalo, N. Y.
Philips & Davies, Inc., 920 Steiner Ave., Kenton, Ohio
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y

PRICE LIST

ON HANNIFIN STOCK HYDRAULIC PRESSES



1-TON	$ 552
2-TON	$ 627
5-TON	$1,286
8-TON	$1,581
10-TON	$1,855
25-TON	$3,681

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

DELIVERY FROM STOCK

Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannifin presses, up to 150 tons. Special, optional controls when needed.

WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

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HANNIFIN CORPORATION, 509 S. WOLF ROAD, DES PLAINES, ILLINOIS

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y
Cosa Corp., 405 Lexington Ave., New York 17 N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton George Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence R. I
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.

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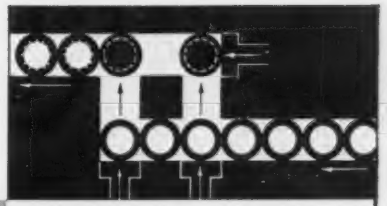
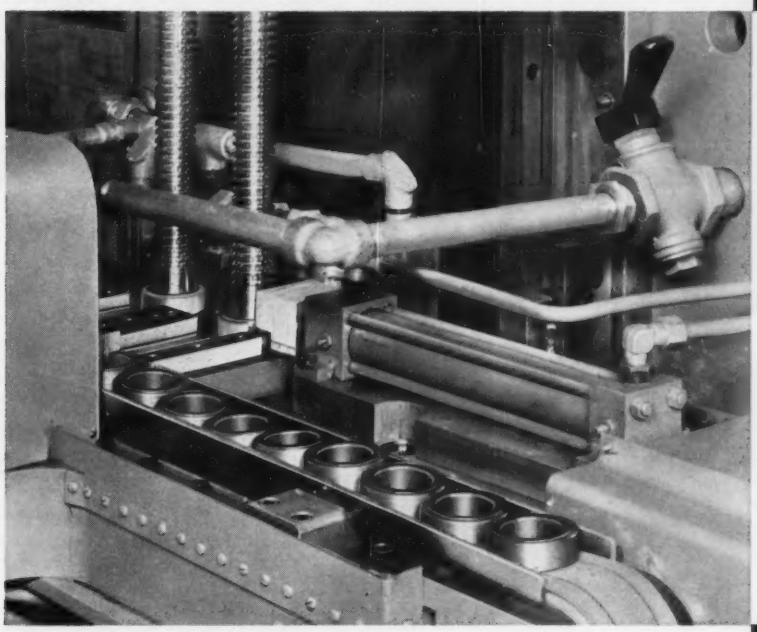
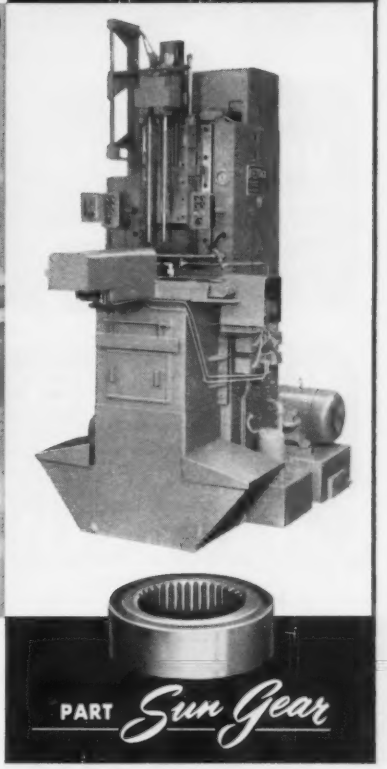
AUTOMATION IN BROACHING!







DETROIT BROACH PROVIDES FULL AUTOMATION WITH FLEXIBILITY OF MANUAL OPERATION

In the designing and manufacture of automatic tooling for this Pull Down Internal broaching machine, Detroit Broach combined all the time and labor saving advantages of automation, plus versatility to permit efficient manual operation when required. This standard machine is designed to support the tail of the broach throughout the entire stroke and, if desired, may be arranged to hold the tool in tension throughout the cut.

On this particular job, parts are loaded, broached and unloaded automatically—maintaining consistent, high quality production WITHOUT AN OPERATOR! Parts are fed to the machine fixture and then carried away on a belt conveyor.

In addition, this machine features:

OPERATION
Broaching 39 involute spline teeth and size minor diameter

PRODUCTION
480 pieces per hour (100% hour)

MACHINE
Detroit Broach 10-ton Vertical Pull Down Broaching Machine with 42" stroke.

1. An automatic safety mechanism which must be actuated by both broaches at the top of the stroke before the unloading cylinder will eject the finished parts. This eliminates any possiblity of costly tool breakage and down time.
2. Should anything interrupt this machine's automatic cycle, an operator can step in and run full production manually until automatic cycle is resumed.
3. Use of standard components wherever possible to keep costs low and to assure simple, time-saving maintenance or replacement.
4. Fixtures designed and built for greatest flexibility . . . for easy conversion to hold other parts or for design changes on present parts.
5. Simplicity of design and construction for convenient accessibility . . . for quick, easy inspection and maintenance.

Why not find out how you, too, can benefit from new broaching techniques and tooling advancements. Our sales engineers will be glad to consult with you at your convenience.

Detroit Broach COMPANY
ROCHESTER, MICHIGAN

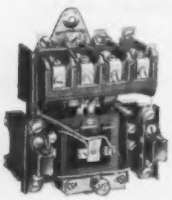
OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

For more information fill in page number on Inquiry Card, on page 255

ALLEN-BRADLEY!
41% of all motor starters were A-B

A survey of 849 motorized machine tools exhibited at the recent Machine Tool Show in Chicago's International Amphitheatre showed that 41% of the motor starters that could be checked were Allen-Bradley. This is almost as many as all other makes combined!

Why is Allen-Bradley so far ahead of all other makes of control? Simply because Allen-Bradley motor starters are more reliable. Their simple solenoid mechanism has only *one moving part*. This means less chance for trouble . . . plus remarkable consistency in operation . . . and *millions* of trouble free operations.



Allen-Bradley starters and relays are a label of quality and add "sales value" to any machine.

Allen-Bradley Co.
1331 S. First St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

A-B Quality

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL
The Preferred Line

Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharp Mfg. Co., Providence, R. I.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
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Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
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Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

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Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

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Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave Cleveland 3, Ohio.

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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Pratt & Whitney Co. Inc., West Hartford, Conn.
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Carboloy Dept., General Electric Co. Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Van Norman Co., 3640 Main St., Springfield 7, Mass.

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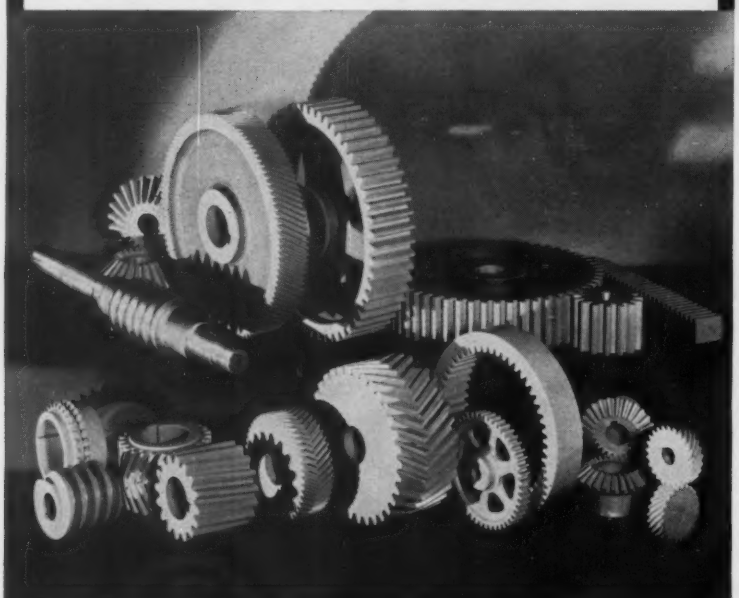

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(*Continued on page* 380)

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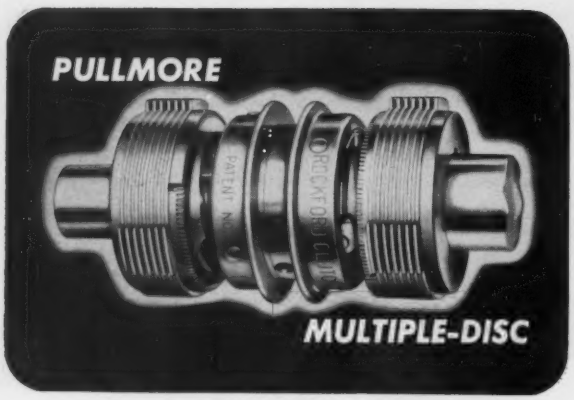

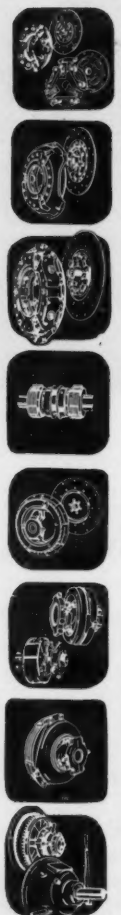

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(*Continued on page* 382)

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(Continued on page 386)

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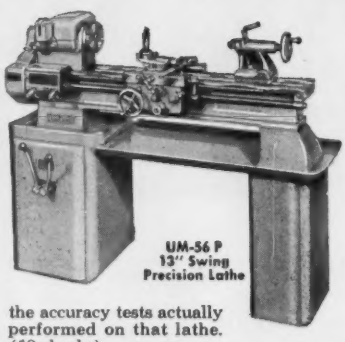

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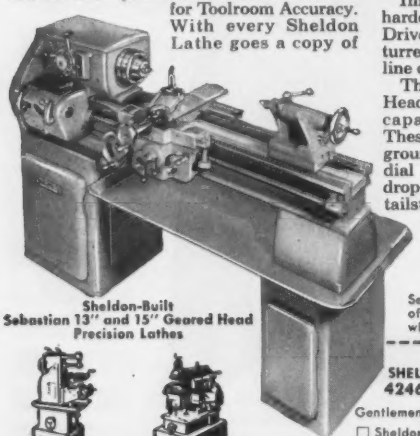

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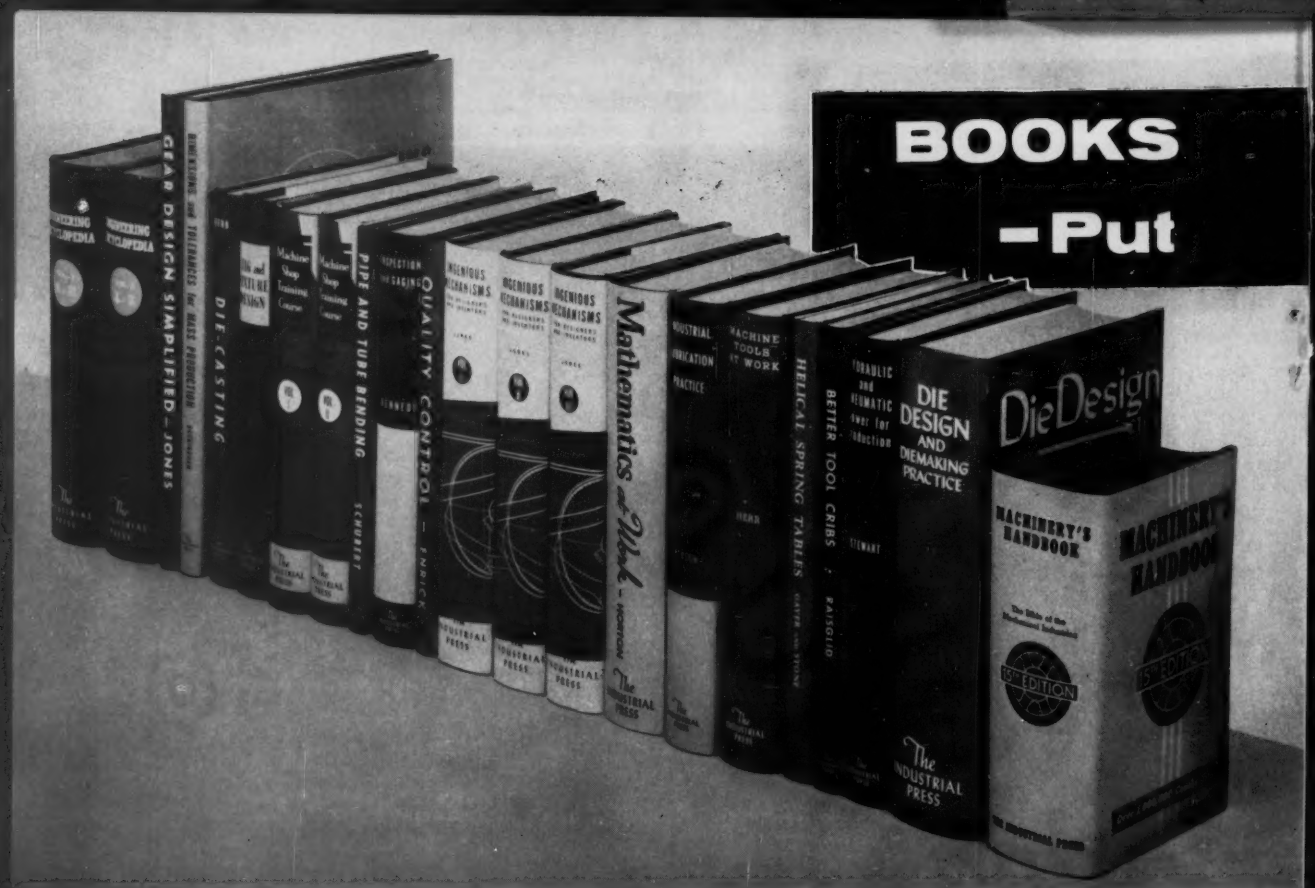

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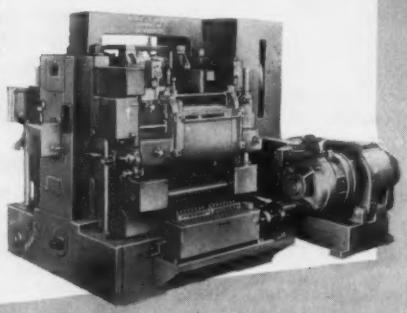

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Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys teel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

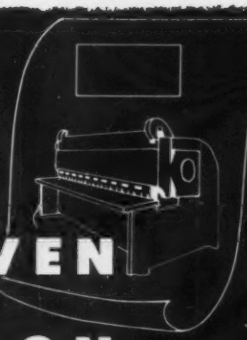
STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa

(Continued on page 390)



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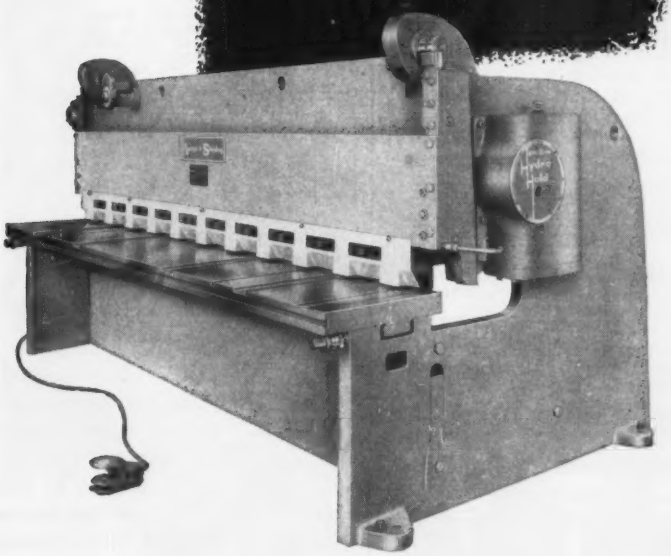

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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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U. S. Tool Co., Inc., 225 North 18th St., Ampere, N. J.

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Chambersburg Engrg. Co., Chambersburg, Pa.
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Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

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Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
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Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Challenge Mchry Co., Grand Haven, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia, 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
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(Continued on page 392)

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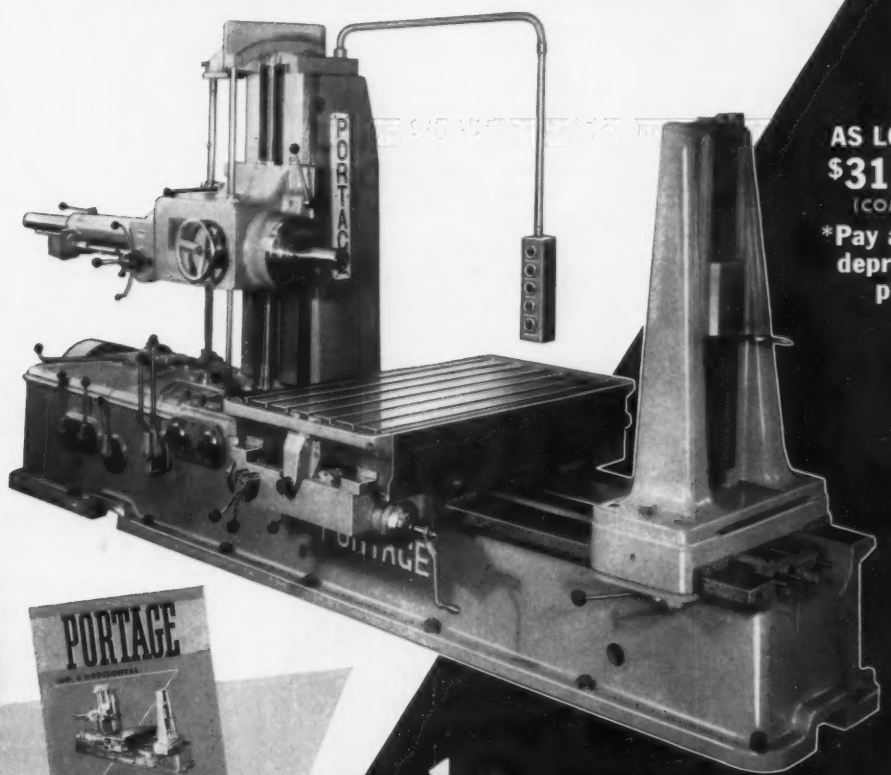

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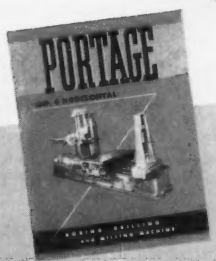

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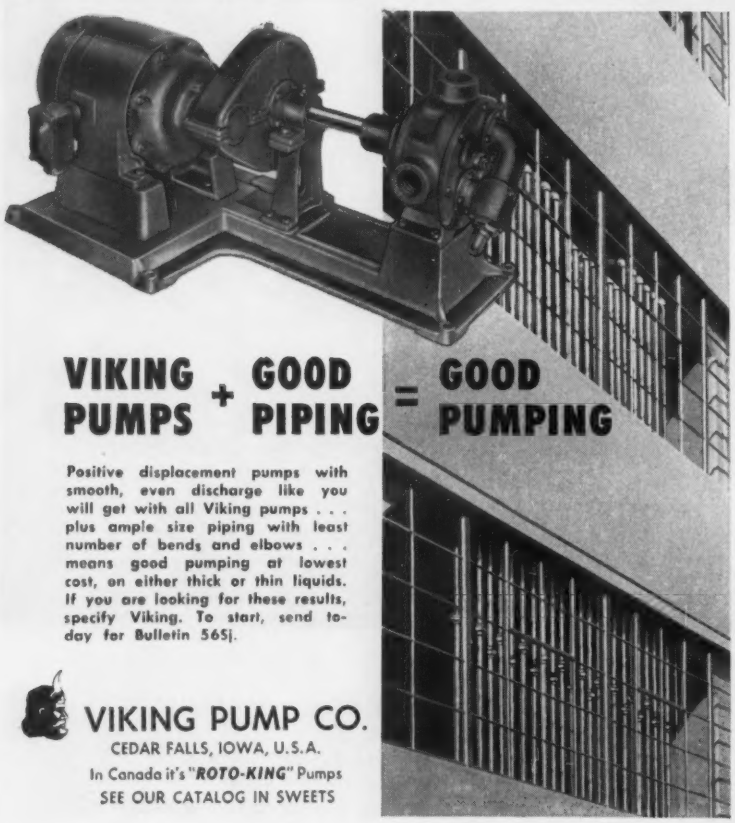

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Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

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Michigan Drill Head Co., Detroit 34, Mich.
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

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Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1 Ohio.

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Cosa Corp., 405 Lexington Ave., New York 17 N. Y.
Coulter, James, Machine Co., Bridgeport 5 Conn.
Davis & Thompson Co., 6411 W. Burnham St. Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn
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Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2 Ohio.
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Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
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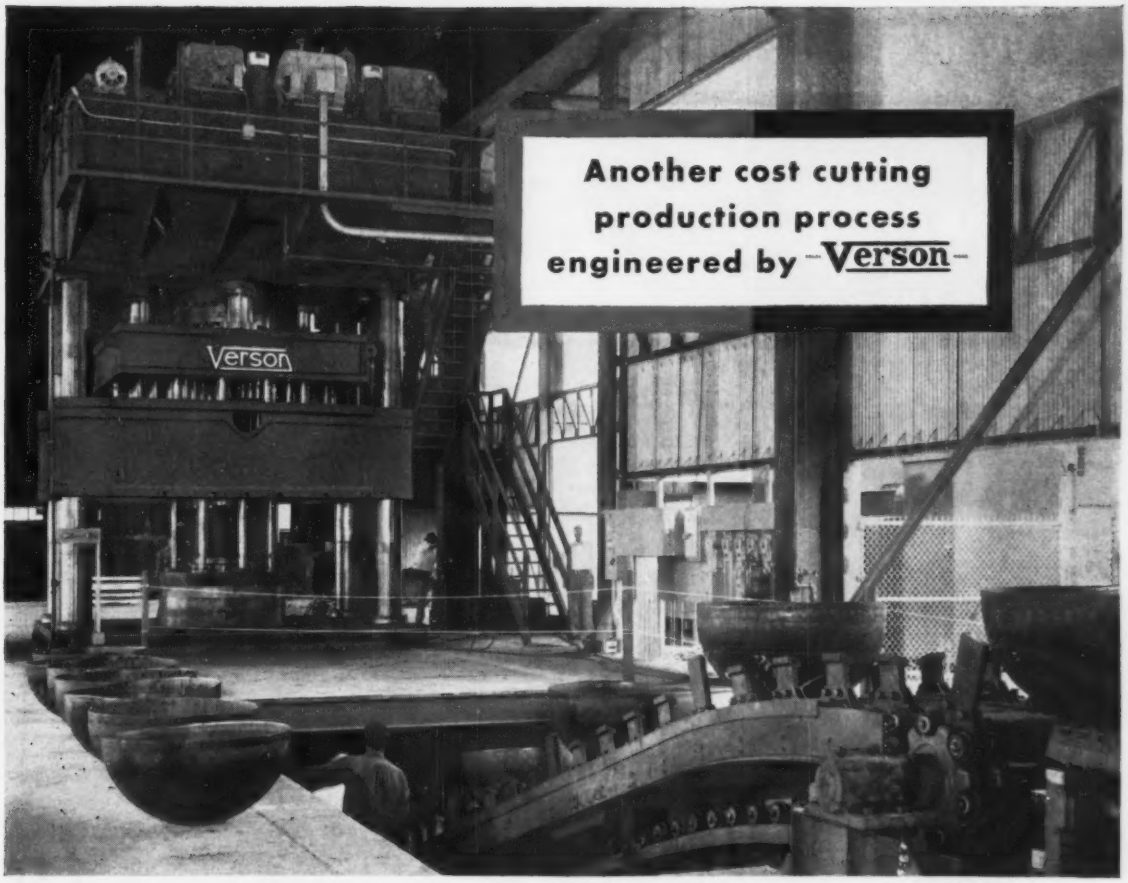
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney Co. Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 394)



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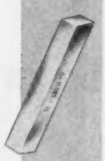

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U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R.R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel
Allegheny Ludlum Steel Sorp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
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Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped
Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Newcomer Products, Latrobe, Pa.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

TOOLS, Lathe, Shaper and Planer
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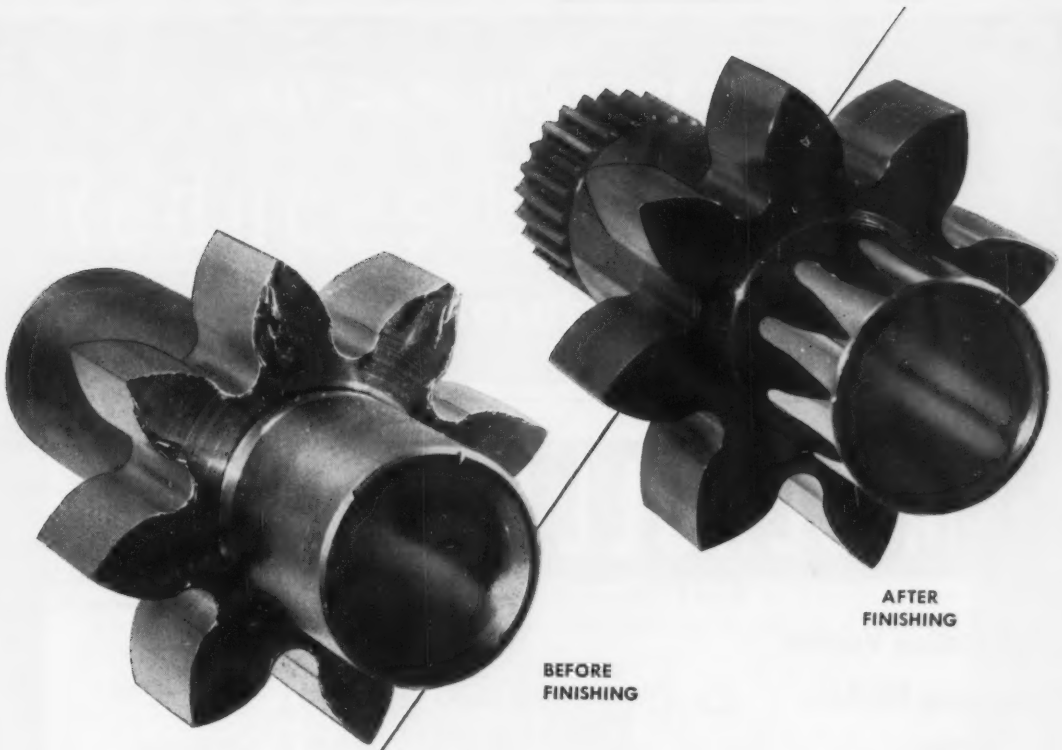
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Lathrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 396)



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(*Continued on page* 398)

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93 Pieces per Hour!

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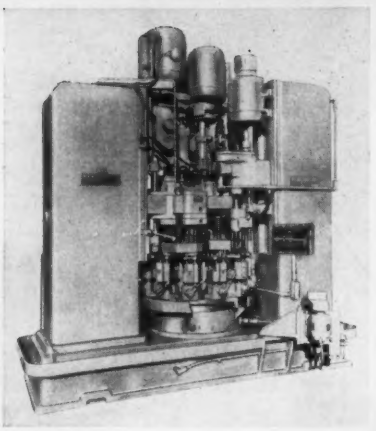

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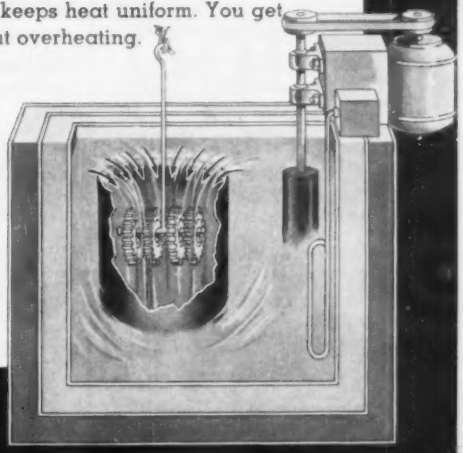

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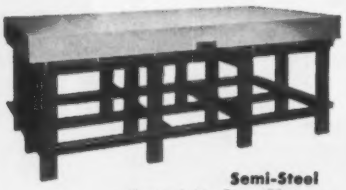

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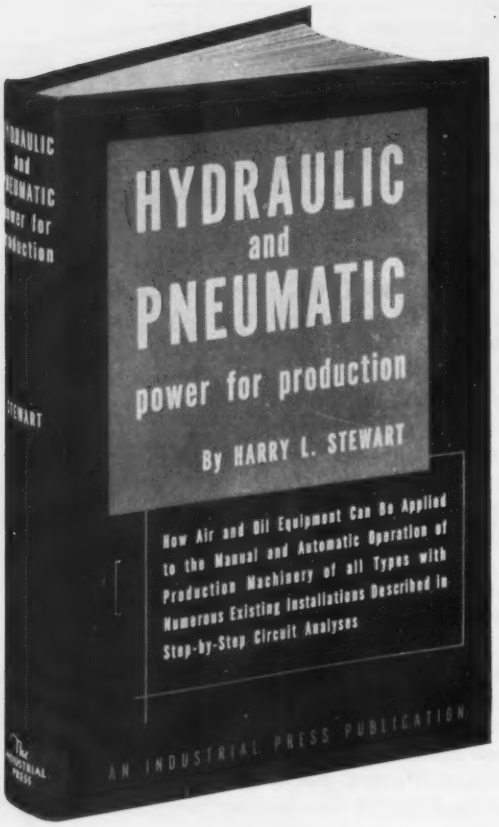
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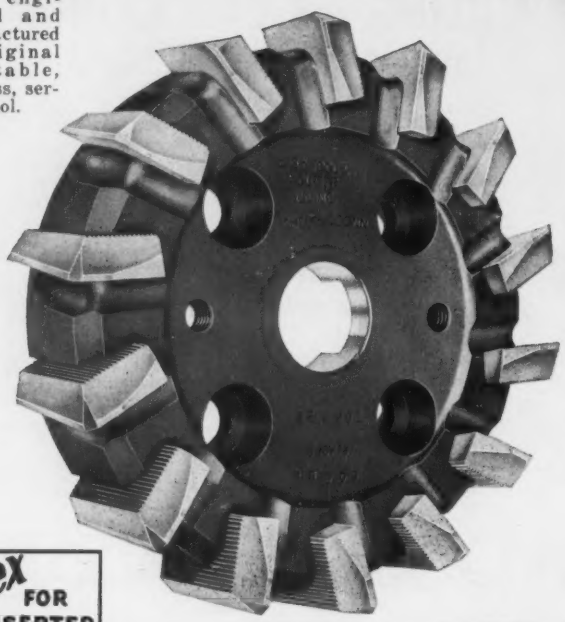

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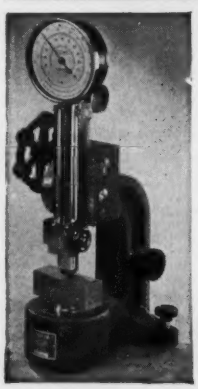

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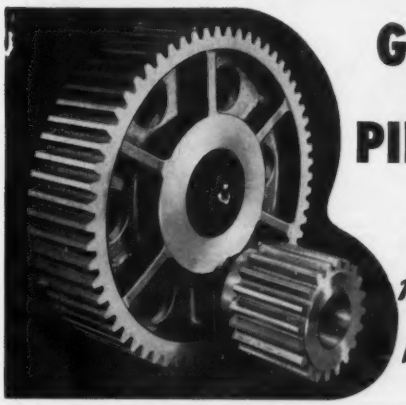

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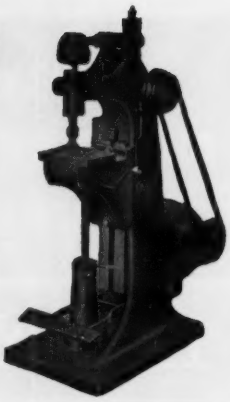

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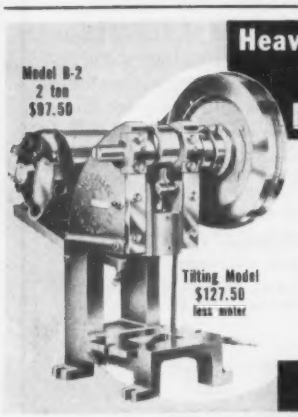

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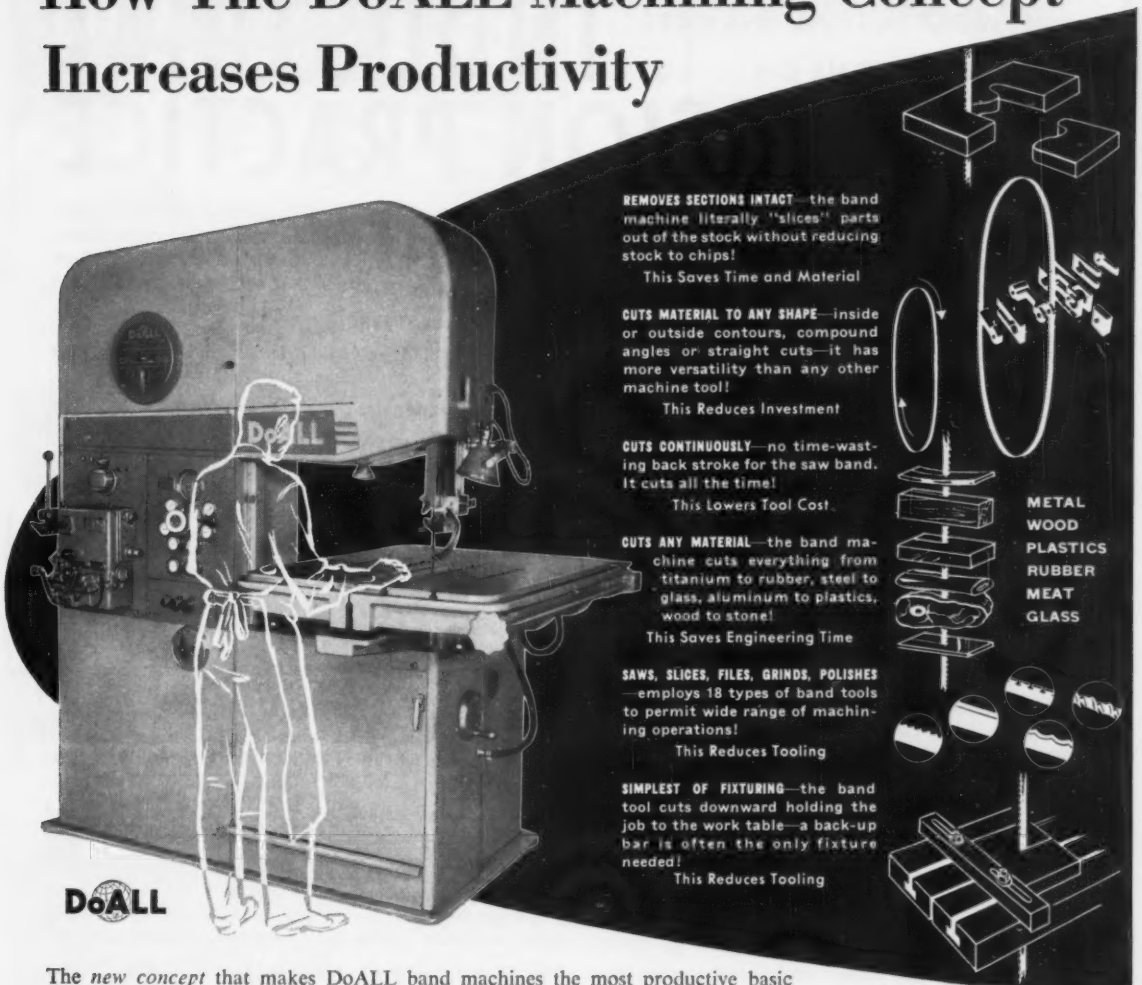
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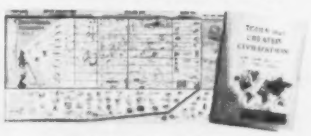

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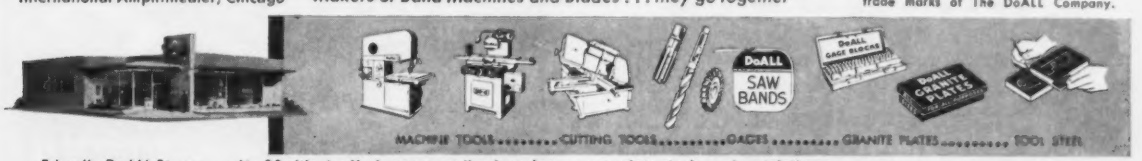

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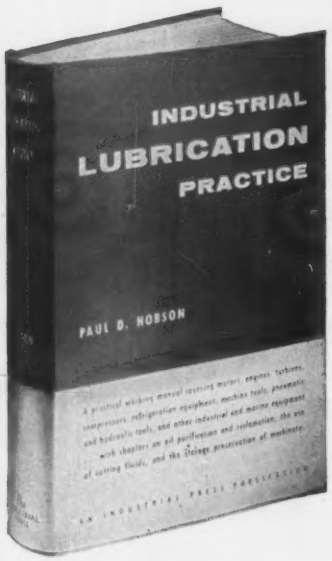

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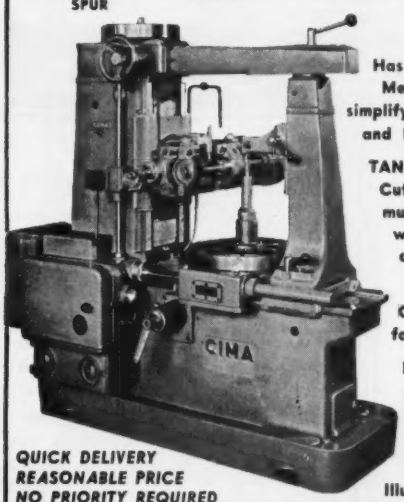

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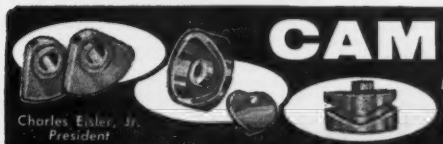

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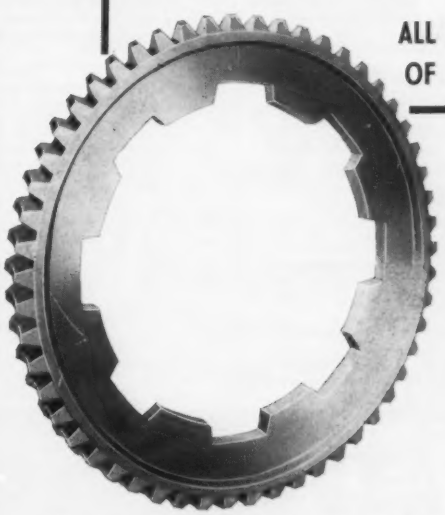

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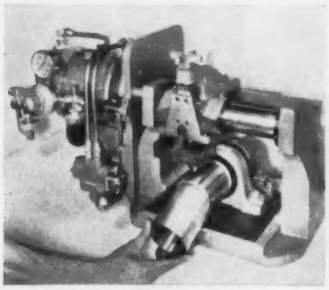

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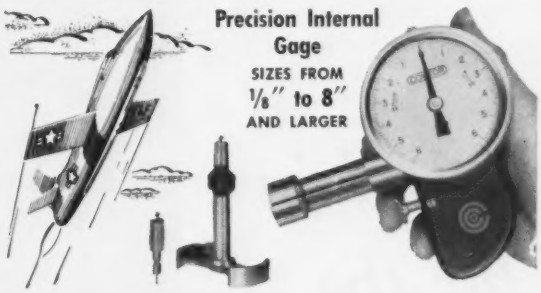

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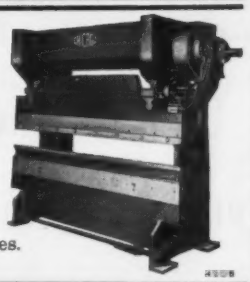

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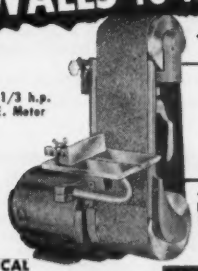

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ALPHABETICAL INDEX OF ADVERTISERS

A

Abbey Etna Co. 261
Ace Drill Corp. 332
Acromark Company, The 409
Ajax Electric Co. 397
Allegheny Ludlum Steel Corp. 102
Allen, Alva Industries 404
Allen-Bradley Co. Insert bet. 32-33, 374
American Brass Co. 49
American Broach & Mch. Co. ..... Insert 85-100
American Felt Co. 82
American Schiess Corp. 363
American Sip Corp 367
American Tool Works Co. 77
Ames, B. C., Co. 324
Apex Tool & Cutter Co., Inc. 402
Armstrong-Blum Mfg. Co. 26
Armstrong Bros. Tool Co. 288
Arter Grinding Mch. Co. 352
Atlas Press Co. 70-71
Austin Industrial Corp. 44
Avey Drilling Mch. Co. 118-119

B

Baird Machine Co. Inside Back Cover
Baldwin-Lima-Hamilton Corp. 279
Ball & Roller Bearing Co. 402
Barber-Colman Co. Insert 85-100
Bardons & Oliver, Inc. 83
Barnes Drill Co. .... Insert 85-100
Barnes, John S., Corp. Insert 85-100
Barnes, W. F. & John Co. Insert 85-100
Baush Machine Tool Co. 293
Besly-Welles Corp. 328
Bethlehem Steel Co. 103-369
Bilgram Gear & Machine Works 407
Blanchard Machine Co. 130
Bliss, E. W., Co. 38-39
Brad Foote Gear Works, Inc. 364
Bridgeport Machines, Inc. 290
Brown & Sharpe Mfg. Co. 242-243
Bryant Chucking Grinder Co. 338-339
Buck Tool Co. 392
Buffalo Forge Co. 351
Bullard Co. 109
Bunting Brass & Bronze Co. 300
Burg Tool Mfg. Co. 66

C

Carlton Machine Tool Co. 54-55
Carpenter Steel Co. 105-402
Challenge Machinery Co. 398
Chambersburg Engineering Co. 294
Chicago-Latrobe Twist Drill Works 306
Chicago Pneumatic Tool Co. 50-51
Cincinnati Bickford Tool Co. 245
Cincinnati Gear Co. 388
Cincinnati Gilbert Machine Tool Co. 292
Cincinnati Grinders Incorporated 6-7
Cincinnati Lathe & Tool Co. 132-133
Cincinnati Milling Products Div., Cincinnati Milling Machine Co. 27-31
Cincinnati Shaper Co. 60-61
Circular Tool Co., Inc. 336
Cities Service Oil Co. 128
Classified Advts. 408
Clearing Machine Corp., Div. U. S. Industries Inc. 285
Cleveland Crane & Engrg. Co. 353
Cleveland Worm & Gear Co. 291
Columbus Die-Tool & Mch. Co. 346
Comtor Co. 409
Cone Automatic Mch. Co., Inc. 123
Consolidated Machine Tool Co. 36-37
Cosa Corporation 40
Cross Company 134-135
Crucible Steel Co. of America 101-107
Cumberland Steel Co. 108
Cushman Chuck Co. 315

D

Danly Mch. Specialties, Inc. 307
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co. 280
Davis Keyseater Co. 404
De Laval Separator Co. 124
Delta Power Tool Div., Rockwell Mfg. 114-115
Denison Engineering Co. 32
Detroit Broach Co. 373
Dialight Corporation 308
Diefendorf Gear Corp. 409
DoAll Company 321-405
Dreis & Krump Mfg. Co. 409
du Mont Corporation 394
Dykem Co. 407

E

Eastern Mch. Screw Corp. 348
Eclipse Counterbore Co. 399
Eisler Engineering Co., Inc. 407
Ekstrom, Carlson & Co. Insert 85-100
Elox Corp. of Mich. 289
Erie Foundry Co. 303
Espen-Lucas Machine Works 319
Etco Tool Co. 68
Ex-Cell-O Corp. 265-269

F

Fafnir Bearing Co. 305
Fairfield Manufacturing Co. 304
Farquhar, A. B. Div., The Oliver Corp. 122
Farrel-Birmingham Co., Inc. 286
Federal Bearings Co., Inc. 254
Federal Press Co. 281
Federal Products Corp 341-342-343
Fellows Gear Shaper Co. 4-5
Ferracute Machine Co. 386
Foote-Burt Company 62
Forst, Oswald 347
Fosdick Machine Tool Co. 287
Fulmer, C. Allen Co. 314

G

Gallmeyer & Livingston Co. 249
Gardner Machine Co. 21
Garlock Packing Co. 366
Gear Grinding Machine Co. 45
Giddings & Lewis Machine Tool Co. 24-25
Gisholt Machine Co. 74-75
Gleason Works 301
Goss & DeLeeuw Mch. Co. 310
Grant Mfg. & Machine Co. .. 404
Gray, G. A. Co., ... 73
Graymills Corp. 390
Greenfield Tap & Die Corp. Insert 67
Greenlee Bros. & Co. Insert 85-100

H

Hamilton Tool Co. 355-356-357
Hanchett-Magna-Lock Corp. 334
Hannifin Corporation 251-372-377
Hardinge Brothers, Inc. 140
Hartford Special Machinery Co. 376
Heald Machine Co., The Inside Front Cover
Heller Tool Co. 327
Hill Acme Co. 371
Hoglund Engineering & Mfg. Co. 271
Horsburgh & Scott Co. 378
Horton Chuck 76
Houghton, E. F. & Co. 329
Hydraulic Press Mfg. Co. 323

I

Illinois Gear & Machine Co. 345
Industrial Press 384-385-400-406
Ingersoll-Rand Co. 313
Innocenti Corp. 274-275

J

Jacobs Manufacturing Co. 41
Johnson Machine & Press Corp. 126
Jones & Lamson Machine Co. 112-113

K

Kearney & Trecker Corp. 22-23
Kennametal, Inc. 349
Kingsbury Machine Tool Corp. 46-47

L

L. & J. Press Corp. 358
Lake Erie Eng. Corp. 64-65
Laminated Shim Co., Inc. 312
Landis Machine Co. 2-3
Landis Tool Co. 10-11
Lapointe Machine Tool Co. 262-263
Le Blond, R. K. Machine Tool Co. 58-59
Lees-Bradner Co. 120
Leland-Gifford Co. 410
Levin, Louis & Son, Inc. 403
Lincoln Electric Co. 387
Linde Air Products Co. Div. Union Carbide and Carbon Corp. 110
Lodge & Shipley Co., The 389
Logansport Machine Co., Inc. 333

M

Madison-Kipp Corp. 78
Marlin-Rockwell Corp. 382
Materials Section 101-108
Mattison Machine Works Insert 85-100
Mercury Engineering Corp. 79
Metal Carbides Corp. 404
Michigan Tool Co. Insert bet. 110-111
Millholland, W. K. Machinery Co., Inc. 396
Minster Machine Co., ... 121
Mitts & Merrill 401
Modern Industrial Eng. Co. 362
Modern Machine Tool Co. 354
Moline Tool Co. 360
Monarch Machine Tool Co. 246-247
Moore Special Tool Co., Inc. 365
Morris Machine Tool Co. 297
Motch & Merryweather Mchry Co. 33
Mummert-Dixon Co. 411

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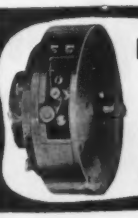

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ALPHABETICAL INDEX OF ADVERTISERS

N

National Acme Co. 42-43
National Broach & Mch. Co. 69
National Forge & Ordnance Co. 104
National Tube Div., United States Steel Corp. 311-317
National Twist Drill & Tool Co. 17
New Britain Machine Co., The ..... bet. 68-69
New Departure, Div. General Motors 296
New Jersey Gear & Mfg. Co., 411
Niagara Machine & Tool Works 18-19
Nichols-Morris Corp. 125
Norma-Hoffmann Bearings Corp. Front Cover
Norton Company 14-15-52-53

O

Oakite Products, Inc. 106
Oliver Instrument Co..... 298
Osborn Mfg. Co. 395

P

Pangborn Corporation 412
Parker-Kalon Div., General American Transportation Corp. 381
Philadelphia Gear Wks., Inc. 30
Philips & Davies, Inc. 346
Pope Machinery Corp. 295
Portage Machine Co. 391
Potter & Johnston Co. 131
Pratt & Whitney Co. 283
Producto Machine Co. 337

R

R & L Tools 117
Reed Rolled Thread Die Co. 322
Rehnberg-Jacobson Mfg. Co. Insert 85-100
Revere Copper & Brass, Inc. 253
Rivett Lathe & Grinder, Inc. 136
Rockford Clutch Div. Borg-Warner 380
Rockford Machine Tool Co. Insert 85-100
Ross Operating Valve Co. 259
Rowbottom Machine Co. 401
Russell, Holbrook & Henderson, Inc. 129
Ruthman Machinery Co. 364
Ryerson, Joseph T. & Son Inc. 142

S

Scherr, Geo. Co., Inc. 407
Scott Paper Co. Insert bet. 33-34
Seneca Falls Mch. Co. 80-81
Sheffield Corp. 35
Sheldon Machine Co., Inc. 382
Shore Instrument & Mfg. Co., Inc. 402
Simonds Abrasive Co. 331
Simonds Saw & Steel Co. 127
Sinclair Refining Co. 116
Skinner Chuck Co. 326
Snyder Tool & Engrg. Co. 56-57
South Bend Lathe Works 359
Springfield Machine Tool Co. 309
Stahl Gear & Machine Co. 403
Standard Electrical Tool Co. 344
Standard Gage Co., Inc. 84
Standard Oil Co. (Indiana) 299
Standard Pressed Steel Co. 20-34
Starrett, L. S., Co. 266
Stuart, D. A., Oil Co., Ltd. 284
Sun Oil Co. 273
Sundstrand Machine Tool Co. ..... Insert 85-100
Super Tool Co. 278
Supreme Products, Inc. 330

T

Texas Company 138
Thompson Grinder Company 111
Thor Power Tool Co. 335
Timken Roller Bearing Co. Back Cover
Timken Roller Bearing Co. Steel & Tube Div. 277
Tomkins-Johnson Co. 375
Triplex Machine Tool Corp. 408
Twin Disc Clutch Co. 370

U

U. S. Tool Company, Inc. 12-13
Union Carbide & Carbon Corp., Linde Air Products Co., Div. 110
United States Drill Head Co. 361
United States Steel Corp. 311-317
Universal Engineering Co. 48
University of Oklahoma Press 403
Used Machinery 408

V

Van Keuren Co. 282
Van Norman Co. 8-9
Verson Allsteel Press Co. 393
Vickers Incorporated, Division of Sperry Rand Corp. 325
Viking Pump Co. 392
Virginia Gear & Machine Corp. 30

W

Wadell Equipment Co. 340
Waldes Kohinoor, Inc. 318
Wales-Strippet Corp. 137
Walker, O. S., Co., Inc. 316
Wallace Tube Co., Div. Wallace Supplies Mfg. Co. 404
Walls Sales Corp. 409
Warner & Swasey Co. 28-29
West Disinfecting Co. 350
Wheelock, Lovejoy & Co., Inc. 368
Wiedemann Machine Co. 320
Williamson Gear & Mch. Co. 404
Williams, J. H. & Co. 302
Winter Brothers Co. 16
Winzeler Manufacturing & Tool Co. 401

Y

Yoder Co. 63

Z

Zagar Tool, Inc. 72

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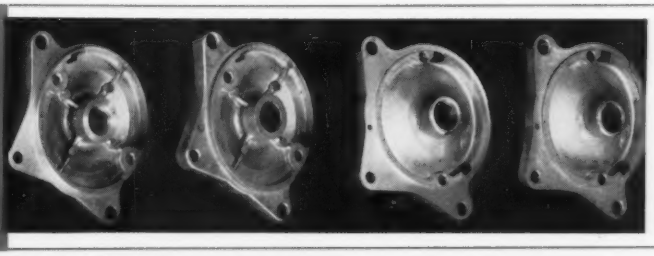

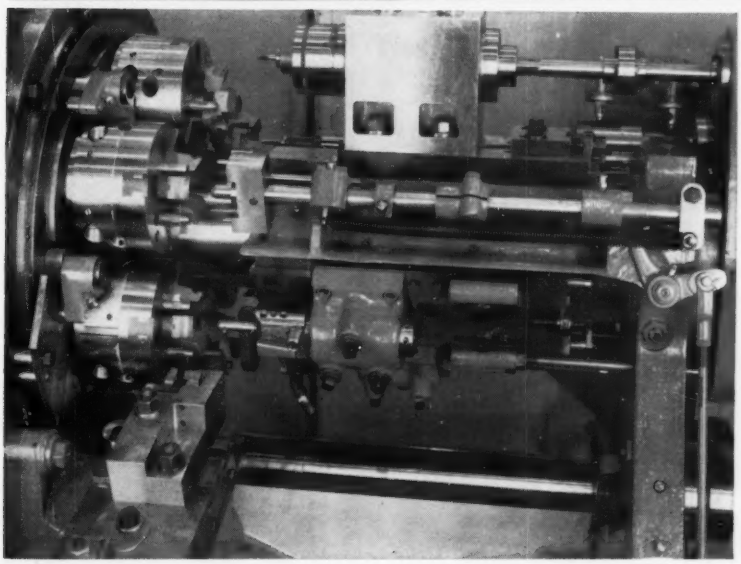

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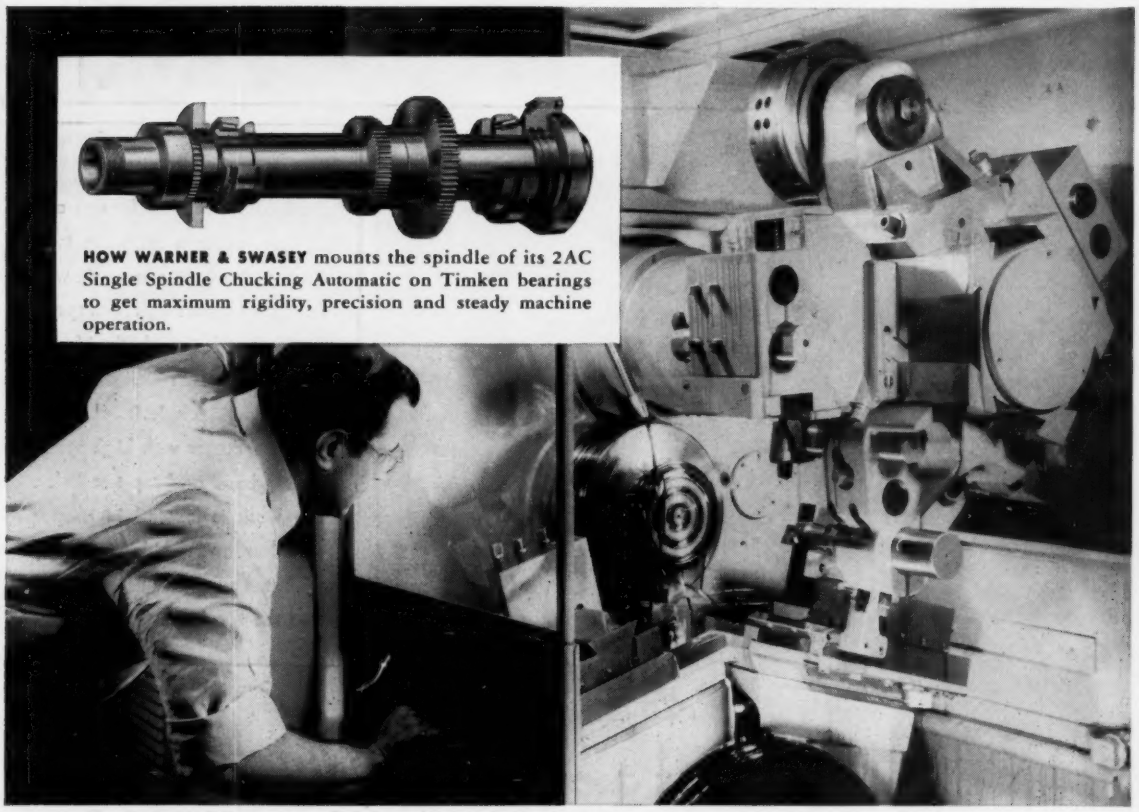
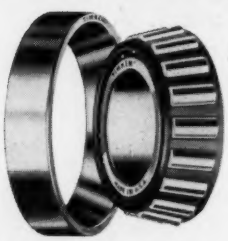


HOW WARNER & SWASEY mounts the spindle of its 2AC Single Spindle Chucking Automatic on Timken bearings to get maximum rigidity, precision and steady machine operation.



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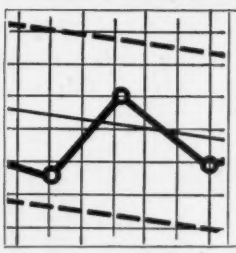

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